ELECTRONICS Australia

January, 1969

Incorporating RADIO, TELEVISION & HOBBIES

Vol. 30 No. 10

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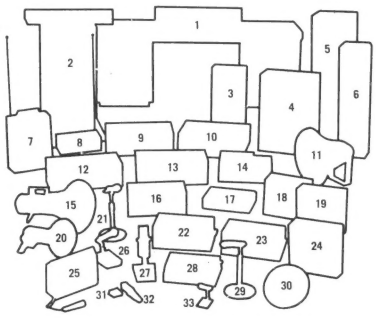

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Anybody seen Jack?

A sure sign of technological progress, so we're told, is the increasing number of high-voltage lines, drooped across our countryside and along our surburban streets. A symbol of progress they may be, but they are also a reminder of the days when we didn't have to put up with the interference which they now cause to radio and television reception.

For years, radio listeners have complained about the way "hash" from high-voltage lines has blotted out the more distant broadcast and short-wave stations. For years, their protests have been met by statements that they have no fundamental right to expect DX reception; that local stations are sited to meet their total radio needs; that modern high-voltage power lines don't cause interference anyway!

Whatever grim logic there may be in such an attitude, it is hard to push it to cover the problem which is growing slowly but surely in some Sydney suburbs. The high-voltage lines (which "don't cause interference") are multiplying, and disrupting television reception—not television DX but television from local 100KW stations! There may be "good" technical reasons why it shouldn't happen, but try reciting them to viewers in the affected areas, whose pictures are scored by two rows of jagged lines; whose pictures flip each time the lines float through the frame sync. interval.

One can, of course, complain to the P.M.G. Radio Branch. They know the problem only too well and they'd be delighted to assist viewers who are plagued by bad reception, and who may not know the reason for it. But, unfortunately, the P.M.G. inspectors can only shrug their shoulders, because they have no power to force the reticulation authorities to take corrective action; nor have they much prospect of winning voluntary co-operation.

What is going to happen in not too many years' time, when viewers begin to install colour television receivers — and expect the kind of visual entertainment they have paid dearly to get? When faulty high-voltage installations in their street paint ragged rainbows across their screens? Must they pray for rain, forthwith, to wash the insulators and wet the poles?

We have recently been provided with breath analyser tests to set a limit on the amount of alcohol the little man may legally drink! How about some meaningful legislation to set a limit on how much interference the big men may legally radiate?

Wanted: A giant killer.

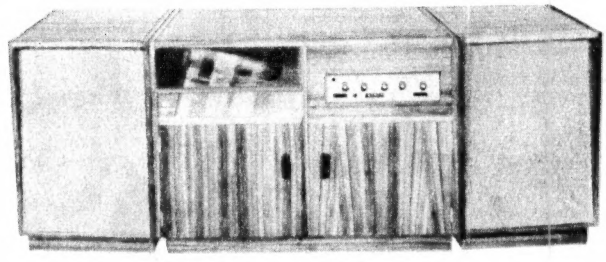
W. N. Williams

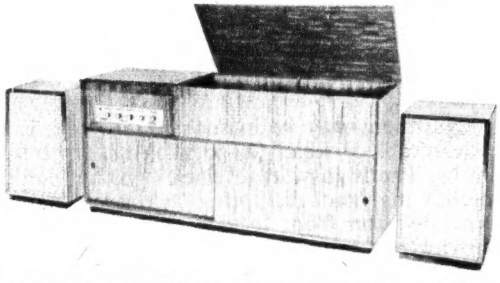
January, 1969

COVER PICTURE: Rolls-Royce Limited have always enjoyed an enviable reputation for the quality of their products. Over and above normal quality control, the Company is very active in the field of materials research and the electron microscope pictured on the cover is typical of the advanced equipment used for the purpose.

INSTROL *hi-fi systems . . .*

There's a custom built Instrol hi-fi System to suit every possible purpose. For example, this prestige system, based on the magnificent new Instrol Cabinets "Series One Thousand." We suggest the Kenwood TK250 Amplifier, and Dual 1019 Player (with Shure M75G magnetic cartridge), plus two Wharfedale Super 12 RSDD Speakers all fitted in Instrol Teak Cabinets one Model 1002 and two of enclosure 1001. Built and tested for $709.50. Many fine combinations can be produced to suit your requirements, with and without tape recorders, in any of the craftsman-made cabinets from the Instrol range. Let us quote you for your choice. You can save more money if you prefer to assemble your own from Instrol Cabinet Kits.





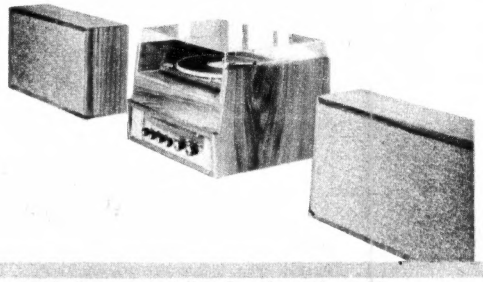
Here's another splendid selection. Take Instrol Model 375 R.S. Cabinet, with two Wharfedale Super 10 Speakers fitted into Instrol Vented Enclosures. The cabinet work may be Queensland Maple, Teak or Walnut. For your amplifier, what better than Instrol, solid state Model 20-20, or Kenwood TK150 or Instrol Model AT1 Amp-Tuner, Add Sony TC255 Tape Deck, and Dual 1015 (with Shure M44MG magnetic cartridge). Cost, within the range of $690.00 and $731.00. The same systems, but without tapedeck and fitted in Instrol Model 250 R.S. Cabinet, between $453.00 and $494.00.

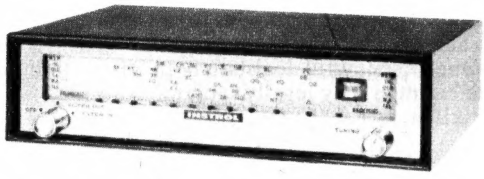
SPECIAL

Two compact, shelf or table mounting systems — quality at very low cost.

(A) Instrol 20-20 Solid State Amplifier, plus BSR UA70 Player, fitted to Instrol Model 75 Cabinet (Teak) which features hinged perspex top. Add two Instrol-Mullard mini speaker systems. $229.00

(B) Instrol 20-20 Solid State Amplifier, plus Dual 1010F or Garrard AT60/2 Player, in Model 50 Cabinet, plus two Instrol-Playmaster Bookshelf speaker Systems (all Teak). $249.00.





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- **Major Stations, all States clearly marked on large illuminated scale. Housed in smart metal box. Available as Amp/Tuner in combination, with the Instrol 20-20 Amplifier, in attractive Teak cabinet (as illustrated) or less cabinet for panel mounting.**

PRICE DETAILS:

T101 TUNER (in Metal Case)	$72.00
T101 TUNER (without case)	$69.80
20-20 AMP. (in Teak Case)	$99.00
Combined 20-20-T101 in Teak Case . . .	$176.00

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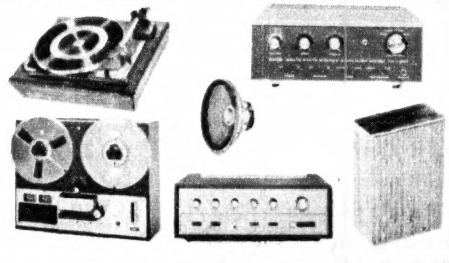

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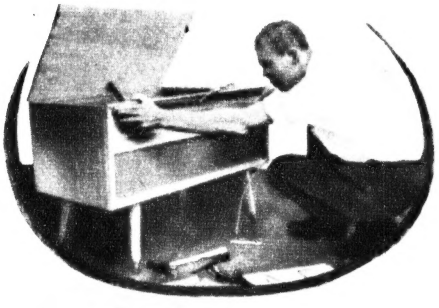

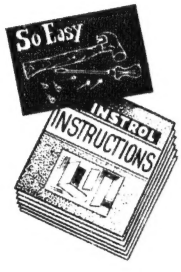

So easy, a child can manage it. The Instrol way — a new simplified method of assembly. A hammer, screwdriver, few hours of your time, and you can make for yourself a complete high quality hi-fi cabinet setting, fully professional in appearance.

FREE
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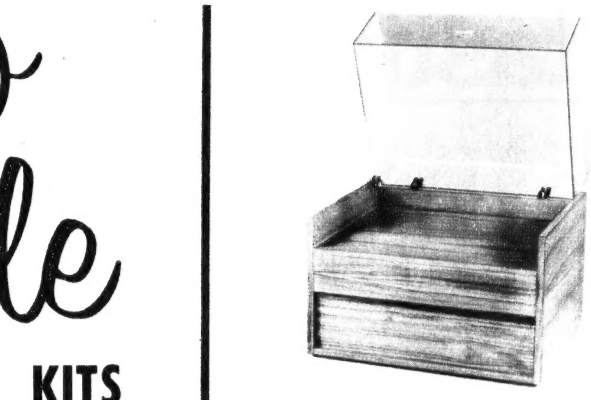
Post coupon, call, or phone for free fully illustrated Instrol hi-fi cabinet brochure. It includes full specifications and down to earth price details of all Instrol cabinet designs. (If writing please include postage stamp.)

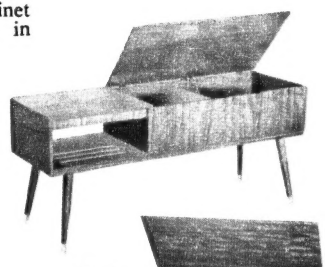
Each kit is complete with all necessary timber parts, plus nails, screws, full, easy to follow instructions. Speaker enclosure kits are complete with acoustic Inner-bond lining felt, and acoustic grille cloth. Equipment cabinet kits include hinges, knobs, catches, sliding stays, castors, slides, leg sets, etc. All timber parts precision cut, fit together smoothly . . . panels are best quality veneered in selected Teak or Queensland Maple. Instrol cabinet designs will cater for virtually any make of speaker, player, amplifier, and tapedeck. If required, all designs are available ready built and polished, but it's highly economical and much more fun to make your own.

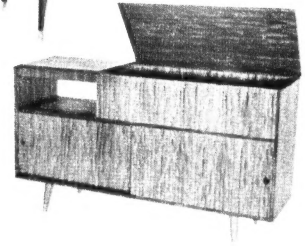


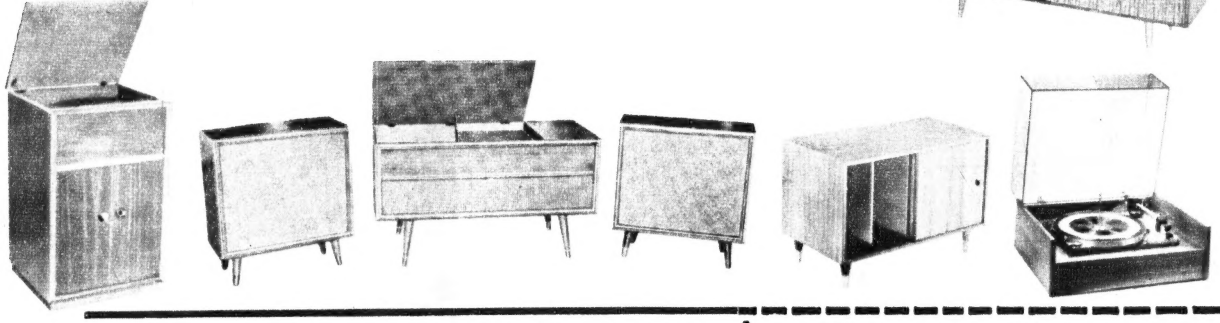
JUST RELEASED. Combined amplifier/player cabinet. Model 75. Complete with friction stay-up perspex cover. Available kit of parts or built and polished.

PRICE

Kit of Parts, Teak	**$29.50**
Qld. Maple	**$26.00**
Built and Polished, Teak	**$38.40**
Qld. Maple	**$34.20**







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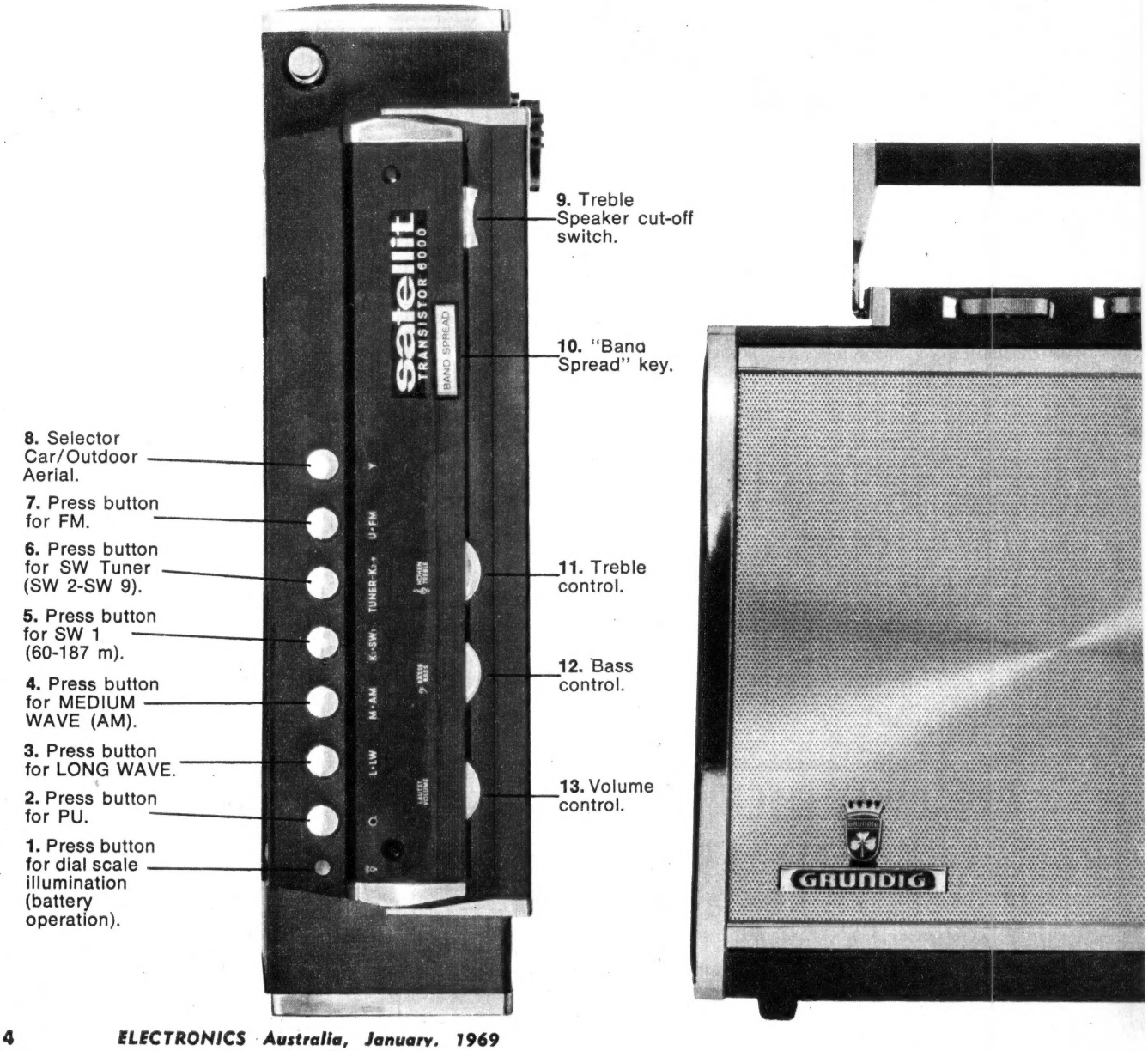
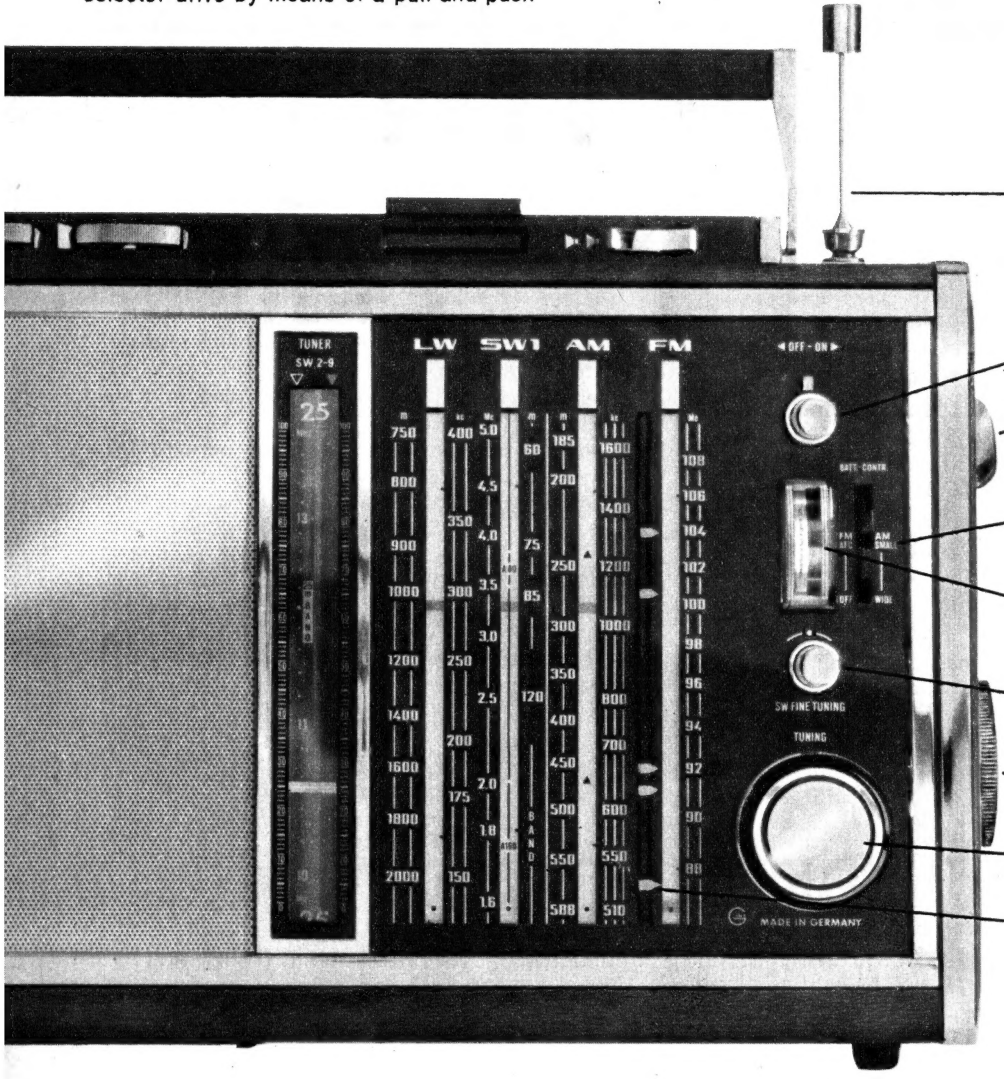


GRUNDIG Transistor 6000

Technical Specifications:

20 tuning ranges: FM, 17 x SW (SW 1: 60-187 m, SW 2: 42-60 m and 49 m band, SW 3: 36-50 m and 41 m band, SW 4: 26,5-37 m and 31 m band, SW 5: 21,5-30 m and 25 m band, SW 6: 16,5-24 m and 19 m band, SW 7: 14-20 m and 16 m band, SW 8: 12-16,7 m and 13 m band, SW 9: 10-14 m and 11 m band), Medium Wave (AM) and Long Wave • circuits: FM 14 (3 can be tuned), AM (without SW Tuner) 9 (3 can be tuned); SW Tuner 14 (3 can be tuned) • 19 + 1 transistors (17 of these are silicon trans) • best possible cross modulation by field effect transistors • 14 + 2 diodes • tuned-in first stage on all ranges • double superimposition of SW Tuner with 4-circuit band filter • gain control: AM 3-stage, SW Tuner 3-stage with additional control, FM 1-stage • ferrite aerial for MW (AM) and LW; MULTI-MATCH telescopic aerial for FM and SW (switchable) • DUPLEX Single Selector tuning • separate SW rotating drum selector drive by means of a pull-and-push tuning knob • colour marks for station tracing • SW fine tuning for SW 1 • "Band Spread" key • switchable AFC on FM • AM band width selector switch • tuning indicator (S-meter) • battery voltage indicator • 2 Superphone speakers (treble speaker can be switched off) • bass and treble control • 2 Watts push-pull output stage • battery operation by 6 x 1,5 V mono cells • built-in mains power pack TN 12 • dial scale illuminated • sockets for external power supply, earphone, external speaker, outdoor aerial, car aerial, outdoor dipole antenna, ground, record player/tape recorder • receptacles for SSB device with switch-over to manual control, sound filter, product demodulator • cabinet: wood, w/leatherette covering, in black and walnut.

Size approx. 44 x 26 x 12 cm
(= 18½" x 10¼" x 5")
Weight (incl. power pack), approx. 6.1 kg (w/out batt.)



14. MULTI-MATCH telescopic aerial for FM + SW reception.

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16. Range selector switch (SW Tuner).

17. Switch for AFC on FM, band width selector and battery voltage control.

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19. SW fine tuning (SW 1 range).

20. Station selector for SW Tuner.

21. Station selector for FM, SW 1, MW (AM) and LW.

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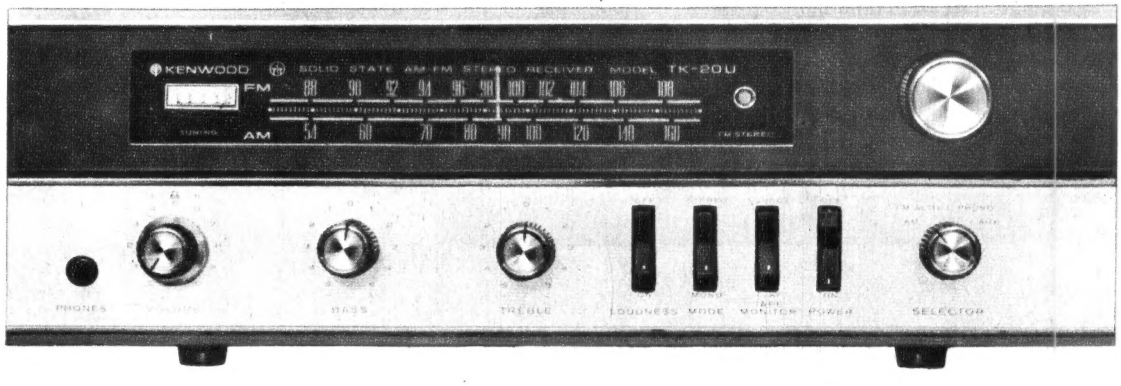

30 WATTS SOLID STATE FET AM-FM STEREO RECEIVER TK-20U

The TK-20U Solid State Stereo receiver powered by Silicon Transistors is reasonably priced (Aust. $219). It performs equally as well as the more expensive models. The features include 30 watts of total music power, (F.E.T. Field Effect Transistor) 3 gang tunging condenser, 5 IF Stages and a magnificent bass and clean treble sound. For greater power, other amplifiers are readily available.

▼ TK-20U

*F.E.T. (Field Effect Transistor) 3 Gang Tuning Condenser frontend for superior sensitivity, image rejection and cross modulation ratio.

*5 IF stages with 3 limiters and wideband ratio detector have been incorporated to provide 40 dB alternate channel selectivity and freedom from noise and interference.

*4-position program source selector permits AM, FM AUTO, PHONO and AUX.

*USABLE SENSITIVITY:
FM: 2.5 microvolts (IHF Standard)
AM: 10 microvolts (IHF Standard)

*TOTAL MUSIC POWER:
32 watts (IHF Standard at 4 ohms)
30 watts (IHF Standard at 8 ohms)

*FREQUENCY RESPONSE: 25 Hz—40,000 Hz

*DIMENSIONS: 14 1/16"(W), 4 3/4"(H), 11 1/4"(D)

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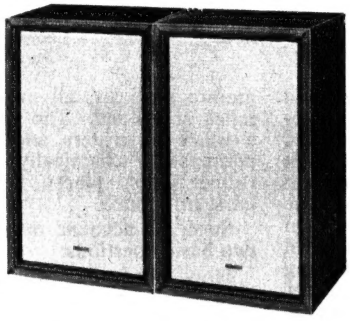

BOOKSHELF TYPF 4-WAY 5 SPEAKER SYSTEM KL-60

▼ KL-60
*60 watts input, 5-speaker, 4-way system
*Designed for use with solid-state amplifiers
*Four-step tone selection
*Completely sealed enclosure
*Smooth 4-way crossover
*Mounted speakers: 12-inch, free-edge woofer×1 (Bass)
6½ inch cone squawker×1 (lower midrange)
4 inch cone squawker×1 (higher midrange)
Horn-type tweeter×2 (Trebie)
*Frequency response: 30Hz to 20,000Hz
*Dimensions: 15"(W), 25½"(H), 11⅝"(D)

40 WATTS SOLID STATE STEREO AMPLIFIER TK-150U

▼ TK-150U
*40 watts of IHF Standard total music power
*All transistor amplifier provides wide 20 to 50,000 Hz frequency response and 20 to 60,000 Hz power bandwidth.
*5 pairs of input terminals for MAG, AUX 1, AUX 2, TAPE REC and TAPE PLAY.
*Damping factor: 40 (at 16 ohms), 20 (at 8 ohms)
*Dimensions: 10¼"(W), 4⅛"(H), 9⅜(D).

60 WATTS SOLID STATE STEREO AMPLIFIER TK-250U

▼ TK-250U
*60 watts of IHF Standard total music power
*Very low IM distortion for exceptional clear sound low level to high level listening
*High damping factor 23 (8 ohms), 46 (16 ohms) for excellent transient response
*2 sets of stereo speaker terminal and front panel speaker selector switch.
*Frequency response: 20Hz—50,000Hz (±1dB)
*Power bandwidth: 18 Hz—60,000Hz (−3 dB)
*Dimensions: 13"(W), 4⅛"(H), 9¾"(D).

A TRIO/KENWOOD PRODUCT

90 WATTS SOLID STATE STEREO AMPLIFIER TK-400T

▼ TK-400T
*90 watts of IHF Standard total music power to drive even low efficiency HI-FI speakers.
*Blow out free exclusive automatic circuit breaker protects power transistors (U.S. Pat.)
*NF type tone control.
*Frequency Response: 20 Hz - 50,000 Hz (±1dB)
*Dimensions: 15¼"(W), 5¾"(H), 12¼"(D).

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Life Outside The Earth's

The mystery of what lies outside our immediate world has exercised the mind of thinkers for many centuries. In the absence of any basis of knowledge, some very strange ideas were proposed, as the picture on the opposite page shows. Now, at last, we are in a position to investigate conditions beyond our own environment and in the forseeable future the question of whether life exists elsewhere in our solar system should be finally resolved.

by Andrew Holmes-Siedle

This article reprinted from RCA's "Electronic Age"

In our impressions of the size and shape of things in space, we have progressed from those of the Middle Ages. However, even now, when the layman thinks of the universe neighbouring our planet, he probably thinks of the artist's impressions of the solar system which he has seen. A bright, colourful company of planets jostle a flaming sun against a crowded backdrop of comets and star clusters. Almost inevitably, however, the artist's impression has been a false one, as we will see below. The astronaut will not get the same impression. The solar system is a very empty place. It is, on average, very dark and cold. In several other ways, it is very inhospitable to any living thing. This article sets out to consider how living things could ever arise there; and what the prospects are for living things when they venture out of the one small, warm enclave that we know will support them—our own atmosphere.

Artists' pictures, of necessity, show the solar system as more crowded than it really is. This is for the simple reason that, if the artist were true to his scale, and then drew the solar system to fit on a six-inch sheet, the sun (to scale) would be a dot smaller than a full stop, and the Earth would be completely invisible as a dot one-millionth of an inch across.

If we lived on the planet Pluto, we would know that the universe is, indeed, a dark, cold place. The light of its "day" is no more than our starlight, since the Sun is so distant that, ordinary little star that it is, it merges into the background of the others. The cold is so intense that air liquefies. With no protecting gaseous blanket of air, the planet bears the full rigours of the "interplanetary medium" —a rain of solid particles (ranging from sand size to rock size) and of charged atomic particles, all moving at several miles a second. The result must be a waste of craters and dust, the dust perhaps so chemically active that a rubber boot, placed upon it, would burst into flame.

Such an account may make us ask two basic questions:

How, then, did we manage to get here?

How can we possibly live out there?

The answer is that our planet is one of the lucky celestial bodies large enough and temperate enough to hold to itself a thin skin of gas. Although a very thin layer over the surface of the Earth's globe, the atmosphere is still enough to make us a "greenhouse," protected from the inhospitability of outer space. We will live out there only if we take our greenhouse with us. This quickly raises a third question, perhaps the most fascinating one: Beyond our own greenhouse, then, is there anything else alive? This we will try to answer as well, but first we will see what the greenhouse is like and how to take it with us.

We find that, quite apart from giving us air to breathe, our greenhouse atmosphere serves us in many ways:

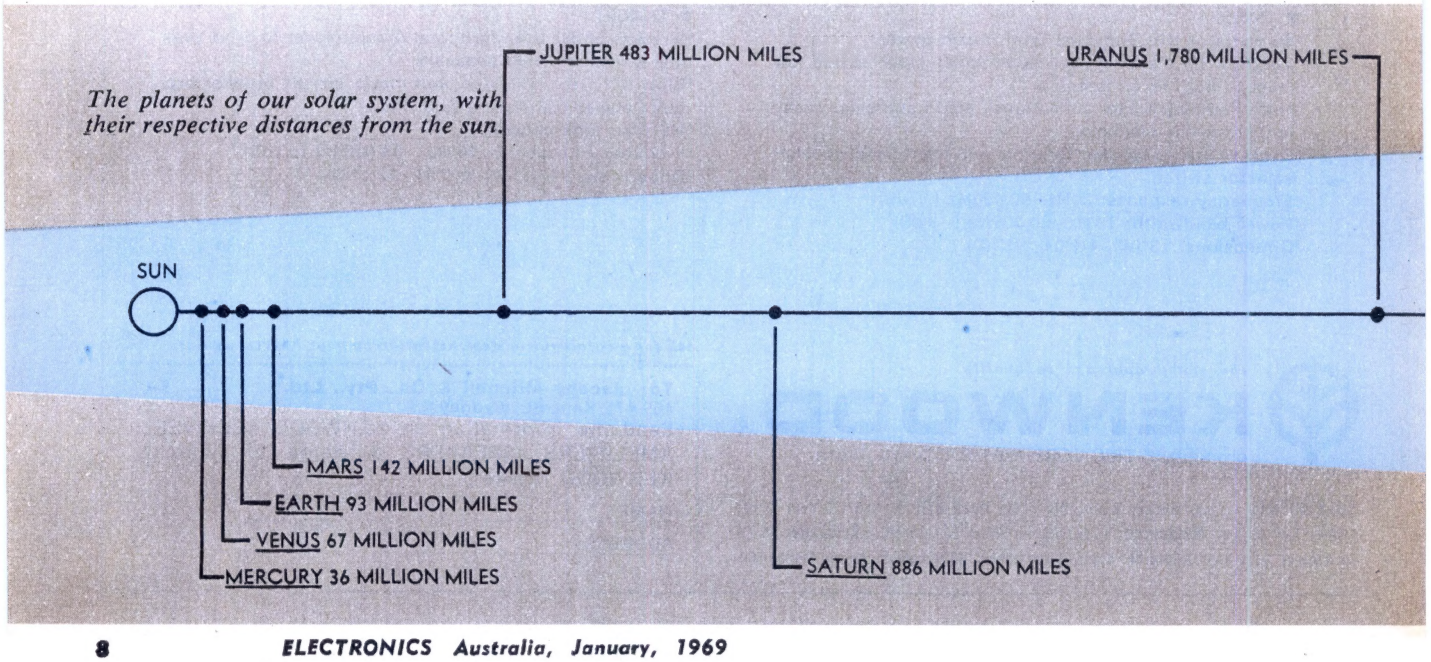
(1) It provides a cooling or a warming system, whichever is needed, to even out extremes of temperature.

(2) It absorbs the harmful ultraviolet light from the sun and the fast atomic particles from space, letting through only a little of each.

(3) It acts as a "meteor bumper," burning up the showers of dust and larger stones that cross our path at thousands of miles per hour.

(4) It acts as a diffuser, softening the sun's light by scattering it; hence, we see a blue and not a black sky and have "twilight" after sunset.

(5) The even distribution of mois-



The planets of our solar system, with their respective distances from the sun.

Atmosphere

This is how an artist who lived in the Middle Ages visualised the world and its surrounds. (From a sixteenth century woodcut in the Bettman Archive.)

ture allows formation of a firm soil that produces plants, which, in turn, produce oxygen and food to keep animals alive; the soil also acts as a disposal system for the husks, bones, hair, or horns of dead animals or of the wastes that our bodies reject from food.

Any manned spacecraft, or Moon base, is mainly a device that reproduces these functions, possibly ignoring the diffusion of light as unnecessary, and, up to now, replacing the oxygen-producing function by tanks of oxygen, while wastes are stored. The Gemini successes have made this seem almost easy. However, for a very long flight, or a long-stay base on the Moon or Mars, we would do well to consider creating, on our base, a microcosm of the oxygen-food cycle that occurs on Earth.

The maintenance of our atmosphere on Earth is done solely by means of the Sun's energy. At the same time as the Sun's energy liberates oxygen from plants, it causes the plant cells to build sugars and other food substances from carbon dioxide. We ingest these foods, extract the chemical energy as "work," and our bodies release chemicals of the type that first went into the plant. If these are "ploughed back" into the soil, the process can start all over again. It would be ideal if we could establish a cyclic process like this in a Moon base.

We would not have to import new atmospheric chemicals just to keep the cyclic, or "regenerative," process under control, using the Sun as a driving force. This, of course, is not a simple matter really, and the fully automatic control of such a process would represent an important engineering achievement.

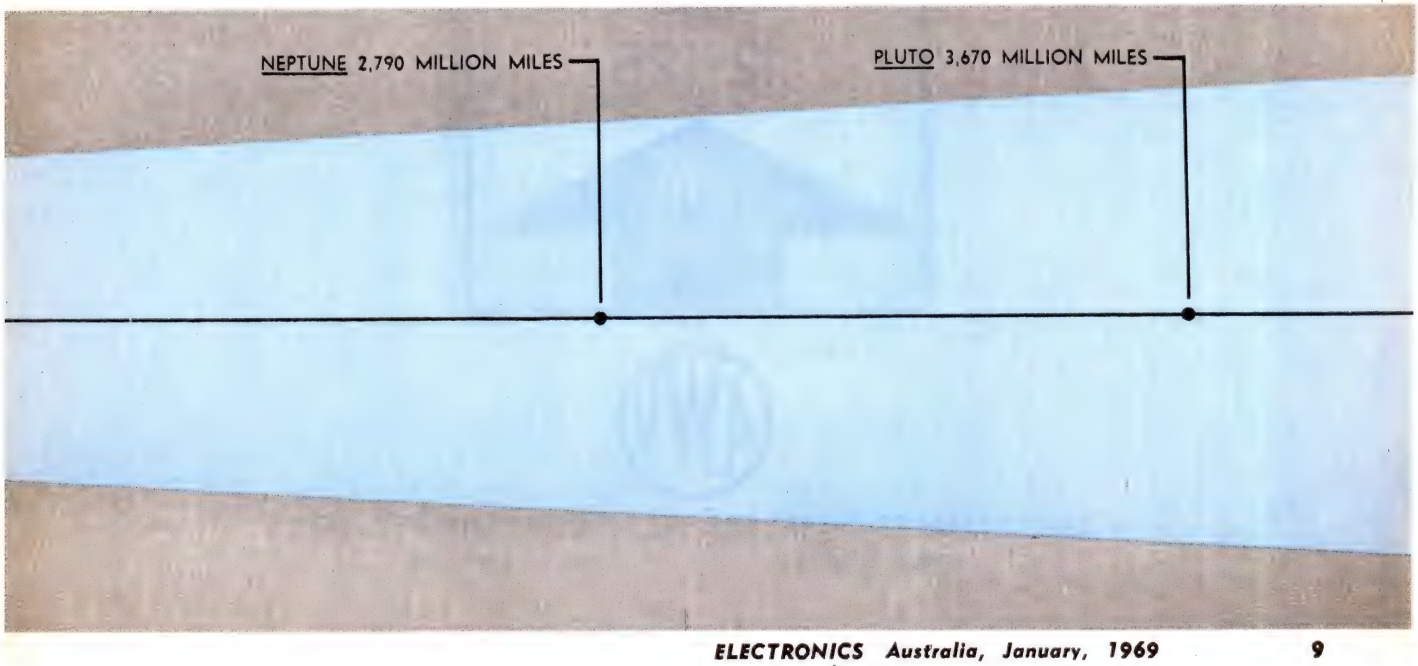
As a basis for the cyclic process, therefore, our Moon base must contain plant life. However, we cannot use all the immense variety of plants that do the work on Earth. We must choose one or two hardy and adaptable ones to do the whole job. The problem is — which to choose?

We might choose the tree on the basis that it is a hardy, powerful plant. It is, but it is not adaptable. A fairly large volume of tree is needed to keep a man supplied with oxygen; also, trees develop very slowly. For each man, a tree would have to be planted about 10 years before he came to the Moon And what to do with all the spare timber? It could not be used for construction; if it caught fire, it would suffocate the whole Moon base.

To give flexibility to our Moon base, we want to choose a plant that packs closely, produces little inedible waste, tastes good, and is adaptable to "flow" production rather than "batch" handling. The best organism is to be found in the nearest fish bowl — the minute, simple "green slime" species chlorella, one of the algae. The volume of chlorella culture needed to serve one man is about a thousand times smaller than that occupied by a tree. Furthermore, using stored sunlight (e.g., electricity, to light fluorescent tubes) as the energy source, a one-man supply of this plant can possibly be packaged in a container the size of a wastebasket.

The chlorella plants double their weight every day, contain most of the necessary vitamins and proteins, and are entirely edible. Here is the food that we need; unfortunately, it is not very palatable. After all, who would want to live exclusively on green slime? Hungry mice, given dried chlorella, sweep it aside and use it as bedding. It can, however, be used to fortify other foods, and "chlorella cookies" containing up to 20 per cent chlorella are edible. On the whole, though, it would be better if we could find, as on Earth, an animal or a fish that would thrive on these useful little plants and then themselves provide us with better fare.

This approach, however, brings more problems. Most animals have a fair pro-



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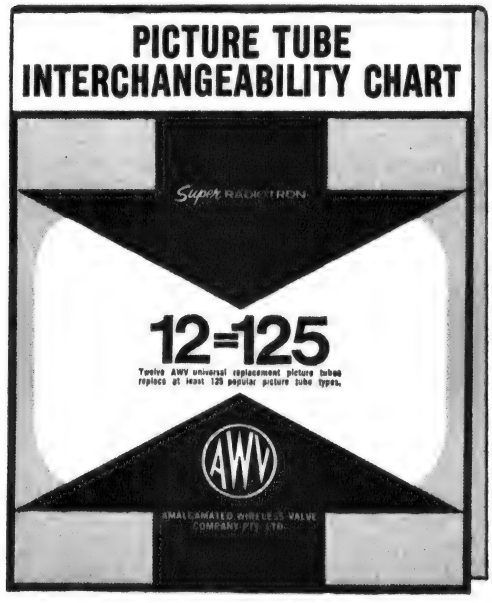

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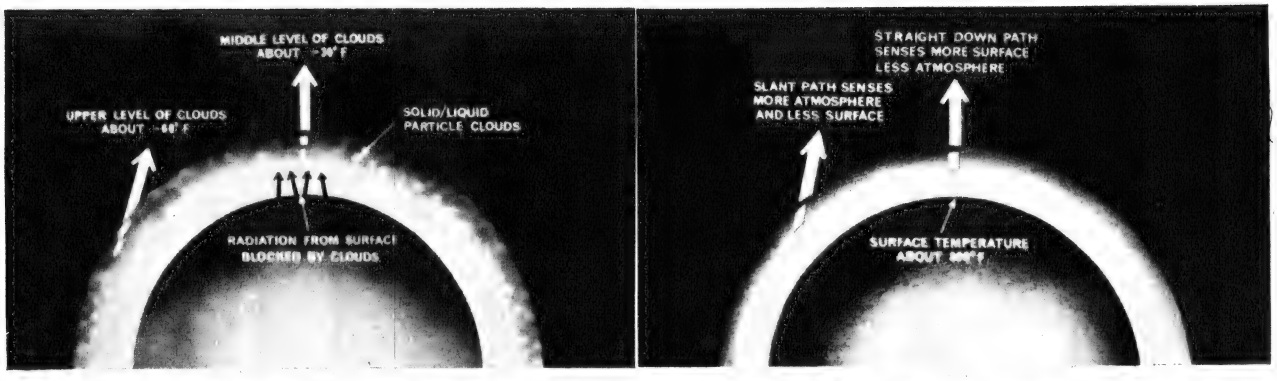


The U.S.A.'s Mariner II space probe to Venus showed that conditions there could not support life as we know it. These diagrams released by NASA, based on information transmitted back to earth by the probe, show that the surface temperature is about 800 degrees F., and that the planet is covered by a thick layer of cold, dense clouds. Venus is 26 million miles closer to the Sun than is the Earth.

portion of bone, gut, hide, or hair that we just cannot eat — one third in the case of catt'e — and we at once have a real rubbish problem on the Moon. We must seek an animal that is completely edible. The slug is one of the few nearly so, and it is eaten in parts of the world as slug jam; but perhaps we might prefer to forgo this treat and compromise on shrimp, the edible insects, or perhaps, just mushrooms. I am sure there are still many bright suggestions for a plant-animal combination that have not yet come to light, and the author is tempted to propose a prize for the best combination suggested. One animal suggested is the tilapia fish, a South American species that enjoys algae, is hardy, tasty, and breeds fast. There should also be a prize for someone who invents slime with an attractive flavour.

We have seen, then, that life, as we know it, requires a protective atmosphere. Now we must consider where we should look for life. This can be reasoned out fairly well on the basis of temperature. There are reasons to say that life at all like that on Earth can persist only if the temperature lies in quite a narrow part of the range between freezing and boiling points. Earth, Mars, and Venus are the only three major bodies in the "comfortable" zone or "liquid water belt" of our solar system.

Let us not, however, be parochial. Mars and Venus apart, we must ask could there be life around other stars? Any star at any one time has a "comfortable" temperature zone around it. The answer is — there is no reason why there could not be life in this zone. There are many biologists who are prepared to say that, if there are any p'anets in the "comfortable" zone of other stars, life is nearly certain to have started on some of them; that the evolution of self-reproducing organisms is almost inevitable given the right mixture of minerals, the right physical conditions, and many millions of years for "chance" to produce the right chemical reactions.

Earth-based biology provides us with some general rules as to what is needed for life. At least three chemical conditions appear to be completely indispensable: (1) a liquid solvent (life must be "wet"), (2) a system of polymers (the thing must hold together), and (3) polymers having the ability to reproduce themselves out of raw materials (reproduction is always in fashion).

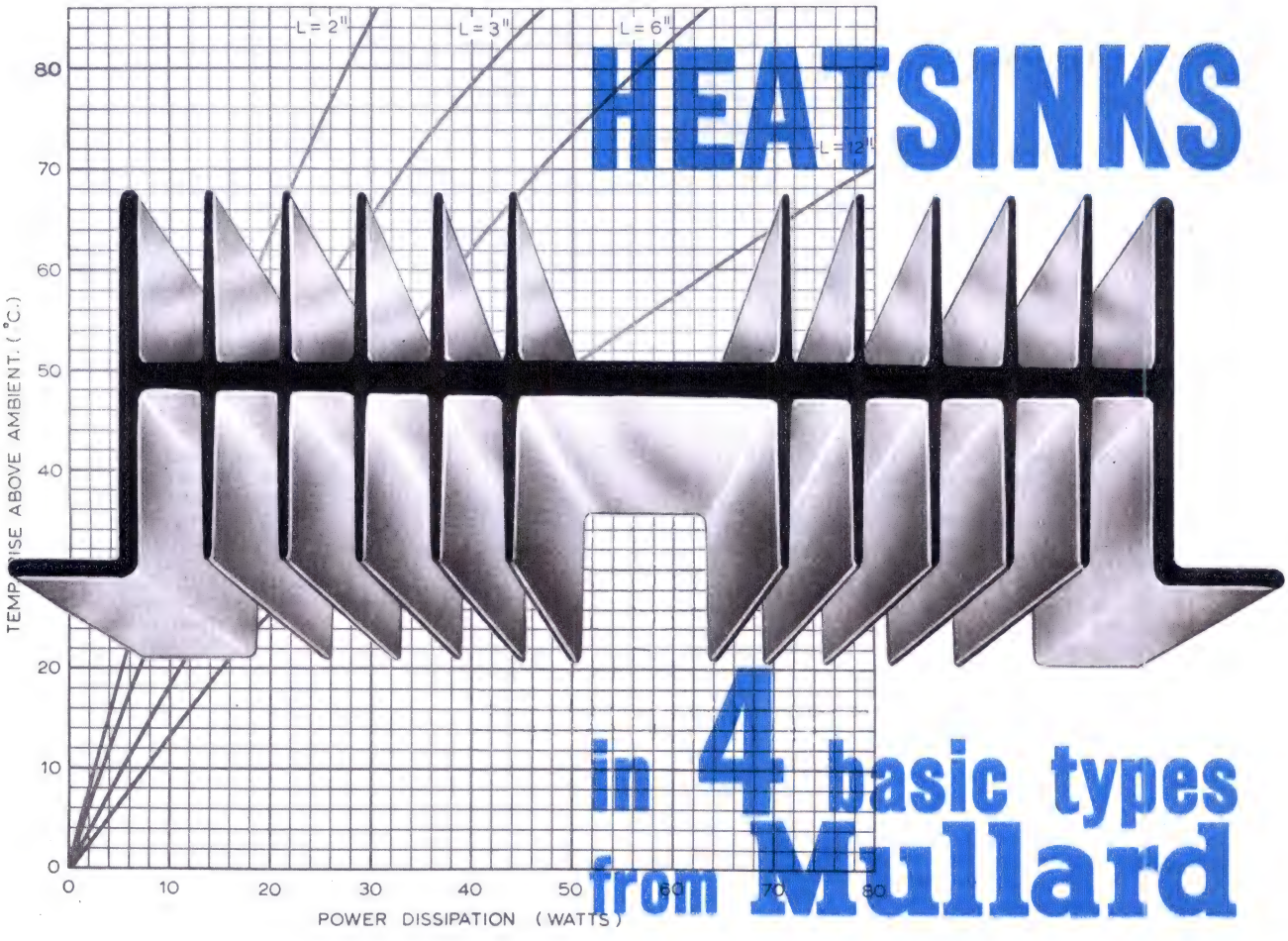
In the case of the Earth, it is not too difficult to propose a model of how self-reproduction of molecules could occur in a warm, sunlit "soup" of amino acids and sugars on a shallow sea bed. Clay could act as a template and allow the laying down of a complex chemical structure. The supported chemical molecule could then act as a "factory" for "zipping up" other simp'e molecules into replicas of itself. The result would be a blob of thickened "soup." If a crust hardens on the blob, we have a primitive biological cell; that is, an array of self-reproducing chemicals protected by a "wall" from being easily dispersed.

We have not, however, so easily solved thereby the secret of life's start; this crude model does not tell us how the primitive "cell" could learn how to divide, as true living cells do, and further, in the process, retain the right geometry and size. This problem is no more than nibbled at in contemporary biochemistry or "molecular biology".

The conditions found on Mars and Venus by the Mariner spacecraft do not look favourable to the kind of processes we have outlined, especially with regard to development of higher life forms. However, we cannot possibly yet pronounce these planets sterile. Even if they finally prove so, it will still be of great interest to discover whether Mars is colonisable at all levels of organism. As world population grows, the possibility of some temperate real estate on Mars may become very attractive. Mars, in any case, is of intense scientific interest because it is near and provides us with a relatively unobserved view of its cloudless surface. Dark patterns and frosty-looking patches come and go annually on the surface, while morning and evening mists can be seen even from the Earth.

Balloon and satellite telescopes should shortly produce a better view of the Martian surface all year round. We have already had the one brief, incredible look by Mariner along a thin strip of surface, which, through no fault of the experimenters, missed some of the more intriguing features. Later,

When the U.S.A. sent its Mariner 4 space probe to Mars in 1965, the Tidbinbilla tracking station near Canberra was one of several engaged in reception of data transmitted back to earth. Here, the director of the station, Mr R. A. Leslie, is watching the record of the data on paper tape coming out of a data recorder.



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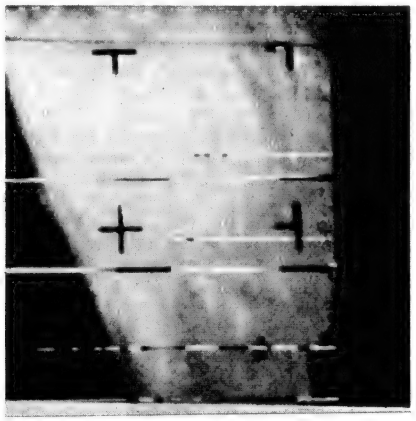
about 1971, automatic biological laboratories will be launched from Earth and will settle on the surface of Mars. These will be electronics systems of a complexity to haunt the designer's dreams. They will have to detect phenomena that are at present only discernible to the trained human eye, such as viewing, under high magnification, the growth of fine moulds on a dish of prepared culture broth.

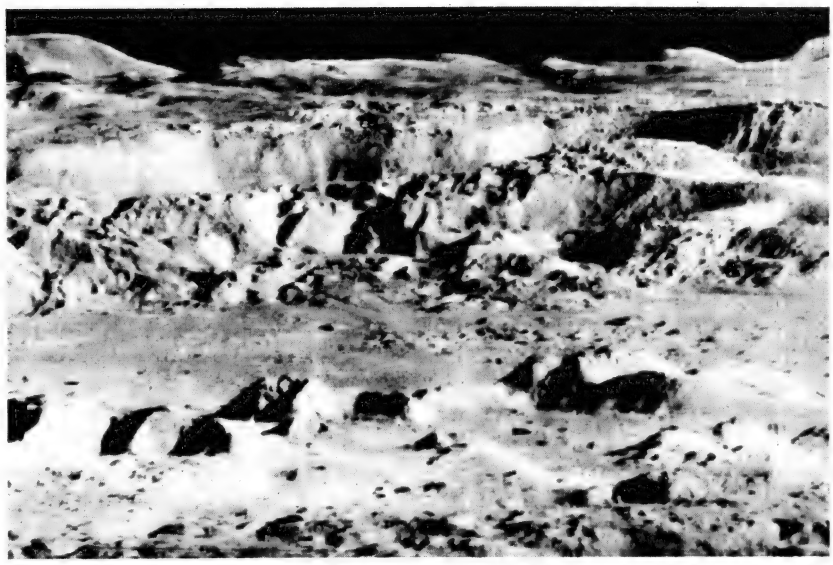
One cannot help feeling that some great issues and decisions may rest on some quite fallible test such as that mentioned. It is so difficult to design a machine that detects them all — elephants, flies, and viruses. For example, from the start, there is no way of knowing the culinary likes and dislikes of the Martian germ. If he is like his earth brother, he has to have his broth just right, — not too salty, not too sour. He may well prefer arsenic to sugar. Perhaps only the TV microscope



The historic first picture received back on earth from the Mariner 4 space probe to Mars, showing part of the Desert of Amazonia. Mars has an atmosphere and the surface undergoes seasonal changes similar to those on Earth.

or telescope will provide us with enough "feel" to recognise highly foreign forms of life or possibly the discovery will wait upon a man's arrival.

The aim of this brief account has been to make three points. Although we can detect life and examine it readily on Earth, the engineers have to give us more advanced sensors before we can decide, by machine, at a distance, whether a certain observed phenomenon constitutes "life." Although we have demonstrated short-term life support outside the atmosphere, our present "Model T" system for support will have to be revolutionised before we can establish a colony on the Moon or Mars. Finally, while we have several good handles on the problem of the origin of life, we have to do a lot of research before we arrive at a good set of principles to explain it. It might be said that the wish to discover these principles is one of the motives of the whole space effort. If we look closely on other planets, we may find out not only if life exists there but how, under different conditions, the vital transmutation was made. There, perhaps, will be the key to our own origin. ■



Devoid of vegetation, airless, sun-scorched by day, sub-zero temperatures by night — this is the natural environment of the Moon's surface. To survive, a moon colony would have to create its own environment, approximating that of the Earth. (This photograph of part of the Moon's surface was taken by Luna Orbiter II.)

"Touchwire" Displays For London ATC Centre

Britain's new Southern Air Traffic Control Centre, at West Drayton, near Heathrow Airport, is to be equipped with a unique "touchwire" display system, developed by the Marconi Company.

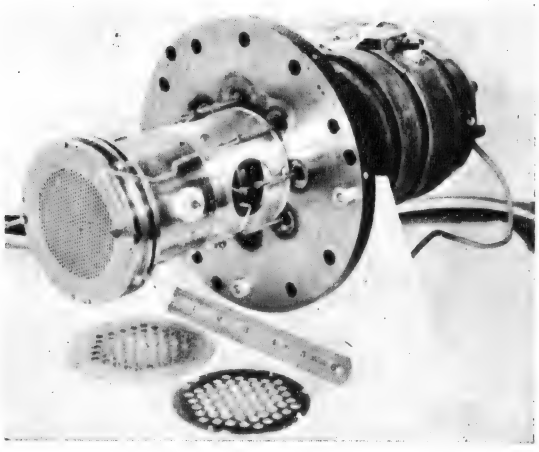
The display units will be part of the £1.5-million Marconi computer-controlled flight plan processing system (FPPS) at West Drayton, due for completion in 1969. The touchwire display is an electronic computer-input device with an infinitely variable range of "keyboard" formats. It is associated directly with the cathode ray tube output display to provide a unique means of conversation between man and machine.

The FPPS system, based on a triplicated Marconi Myriad computer complex, will handle flight plans and control data for all aircraft under en route control in the southern half of the country. Seventy-four of these touchwire displays, part of Marconi's X2000 series, will replace push-button controls and keyboards and will bring the Air Traffic Controller into direct, finger-tip contact with the situation in the air.

The touchwire display comprises two units; a mask which fits in front of the cathode ray tube display screen, and a logic unit. Wire contacts are fitted into the lower part of the mask and the system is so arranged that a finger touch on any of these contacts results in a unique code being transmitted to the computer. Associated with each contact is a 'window' in the mask which allows computer-generated labels in the form of data or aircraft movement information to be displayed. Each of the 8½in displays for West Drayton will have masks with 24 of these windows, although 32 can be provided. Data input to the computer for processing is achieved by touching the contact beneath the window in which the selected data is displayed. It is believed that the touchwire represents the first data input device to work at a speed compatible with the very high operating speeds of present day electronic data displays and computers.

From the operating point of view, the system is a considerable improvement on the mechanical keyboard which it will supersede for many applications, and operators have shown a marked preference for it. Having no moving parts and fewer electronic components than a keyboard system, it is silent and much more reliable.

Since the procedures the controller follows on the touchwires are pre-programmed into the computer, the possibility of error is greatly reduced. The touchwire system ensures that information fed into the computers is logical and complete for its particular context. Other features of the touchwire displays, such as the direct association of information with the contacts, a constant displayed record of previous information and a backtrack facility, make further significant contributions to operational accuracy and efficiency. ■



ELECTRIC PROPULSION for space vehicles

An electric propulsion engine representing the first stages of a technique which may lead to important economies in the construction and operation of space vehicles was exhibited at the Farnborough Air show in the U.K. last September. Although still experimental, the engine can operate satisfactorily under simulated space conditions.

The concept of low-thrust electric propulsion is not new. Rocket engineer Hermann Oberth discussed such a system in 1929—but translation of the idea into hardware has had to await developments in other scientific and engineering disciplines. Furthermore, until quite recently, spaceflight had not advanced to the stage where specific applications could be investigated.

In the electric engine, as with the more familiar chemical-fuel rocket thrust is derived from the high-velocity expulsion of exhaust from the engine. But instead of the chemical product of combustion, this exhaust consists of positively charged atoms, or ions. The thrust generated by an ion engine depends (again as with a chemical rocket) on two things — the rate at which the unit consumes fuel, and the velocity of the exhaust. Put mathematically, $P = MV/T$ where P is thrust, M/T is mass-flow/second, and V is exhaust velocity. For a given thrust, a smaller mass-flow (which is economical) is possible if V can be increased.

The significance of exhaust velocity is brought out by examining the equation, applicable to any rocket,

$$V_R = V_E \log_e (m/m_o)$$ where V_R is the velocity imparted to a rocket, of initial mass m, by the consumption of a mass $(m-m_o)$ of fuel with an exhaust velocity V_E. The mass of the rocket when all the fuel has been consumed is m_o. It is clearly desirable that the percentage fuel weight should be as low as possible so that the mass ratio m/m_o should tend to unity.

The most active chemical rocket fuel is liquid hydrogen/liquid oxygen, which gives an exhaust velocity of 3.5-KM/second. In contrast, exhaust velocities of between 10KM/second and 100KM/second are normal with ion engines.

The first experimental electric propulsion system, SERT 1 (space electric rocket test) was flown by the United States of America in 1964 and a number of other systems are under development in the U.S.A, Europe and (presumably) Russia. The U.S.A. is currently pursuing two electric propulsion programs. The first is SERT II, directed towards demonstrating the long-term operation of an ion engine in space, while the second, SEPST (solar-electric propulsion system technology) is designed to develop the hardware necessary for the support of flight-rated systems in orbit.

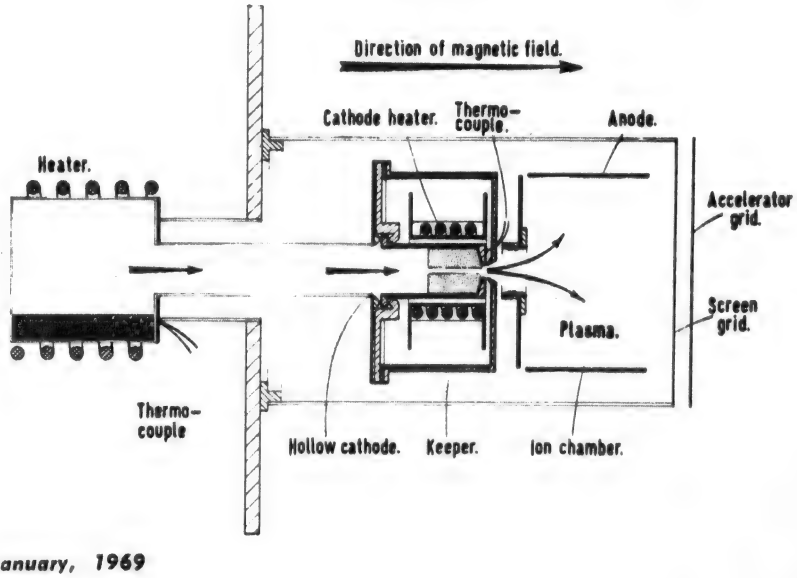
Two possible fuels, mercury and caesium, may be employed in ion engines. Both satisfy the requirements of low boiling point, low ionisation potential and relatively high atomic weight, but mercury is easier to handle and is less reactive chemically and so is preferred.

Three basic operations characterise the operation of the ion engine. These are: the production of ions; their acceleration in an electric field; and the neutralisation of the resulting ion beam. In the British unit, mercury vapour from a heated reservoir is introduced into a hollow cathode; the inner surface of the cathode is coated with a mixture of barium, strontium and calcium carbonates, which emits electrons copiously at relatively low temperatures.

The engine is started by striking an arc between the cathode and a keeper electrode. Electrons are liberated and pass through a small orifice in the cathode into the ion chamber, together with (initially) vapour consisting of neutral mercury atoms. Ions are produced by electron bombardment. A magnetic field is established within the ion chamber by means of electrical windings around the outside of the chamber. The purpose of this is to compel electrons to move in a circular path around the axis of the chamber, so as to travel the greatest possible distance (and therefore have the maximum chance of colliding with, and ionising, neutral mercury atoms) before arriving at the wall of the ion chamber, which constitutes the anode. After a short time, therefore, the ion chamber is filled with plasma (a mixture of neutral mercury vapour, electrons and mercury ions).

At the end of the ion chamber opposite to the cathode are two grids, with very small separation between them. The first is the screen grid, which is maintained at a potential slightly less than that of the cathode. Its function is to provide a barrier to electrons and prevent them from leaving the engine with the positive ions, which would lower the efficiency of the engine. The second is the accelerator grid, and this is maintained at between 1,000-3,000 volts negative with respect to the cathode. Mercury ions which drift into the region between the grids are accelerated out of the engine at a velocity which varies with the accelerating voltage.

The magnitude of the thrust is given by the equation $W=PV/2\eta$ where W is the power of the exhaust beam, P is thrust generated, V is the velocity of ions in the beam, and η the efficiency of the engine. Typical values for these quantities are: W=500 watts,



ENGINE

by Michael Wilson

V=30KM/second, η =90 per cent, leading to a thrust of 0.015 newton, or about 0.03KG.

Continued expulsion of ions would result in a gradually increasing negative charge on the engine and its spacecraft, which would eventually prevent the engine from functioning. It is therefore important to maintain an electrically neutral spacecraft structure, and this is achieved by neutralising the ion beam after the ions have been accelerated. Electrons, drawn from the cathode, may be discharged into the beam from a suitably shaped probe without disturbing the beam.

The pacing factor in the development of an efficient and economic ion propulsion system has been, until recently, the lack of a light-weight electrical power source. While chemical rockets are self-sufficient (needing only fuel and oxidant), ion engines require large quantities of electric power. The British engine, for example, consumes, in all, some 550W (including power conversion supplies and heater), which requires about 80sq.ft. of solar-cell array, assuming a solar intensity equivalent to that at the surface of the earth. Solar intensity falls off rapidly with increasing distance from the Sun, and for voyages to Mars or Jupiter, the array becomes unmanageably large. Resort must then be had to onboard power generation — for example using isotope decay reactors.

But the solar cell array remains the most effective power source currently available, and recent advances in solar cell technology have made possible the development of flexible, lightweight arrays using very thin silicon cells. The power/weight ratio of such arrays can be as high as 50 watts/KG, about twice the value of the lightest arrays built so far. Improvement in specific weight is of supreme importance in ion propulsion payloads.

The weight of the large area of array needed (only about 15 per cent, of which actually consists of silicon cells) means that power generation accounts for a very large proportion of the satellite or rocket weight. A further disadvantage of large-area arrays is the difficulty of stowing them within the confines of the rocket's heat-shield. The need for a folding and deployment mechanism further adds to the weight of the array.

The primary use for electric propulsion could be to expand the orbit of a satellite to a desired distance; a secondary use could be that of attitude control and station keeping. In all cases, using electric propulsion in the primary mode allows payloads to be placed in an orbit otherwise unattainable using the booster rocket alone. With a 500-watt ion-thruster, the same vehicle could place a 120KG satellite (containing 34KG of useful payload) into synchronous orbit using about 24-KG of fuel and an orbit-expansion

(Continued on page 142)

NEW SOLAR ARRAYS ARE 75% LIGHTER

Flexible solar cell arrays capable of providing up to 30W per pound of array weight have been developed by Lockheed Missiles and Space Co., Sunnyvale, California.

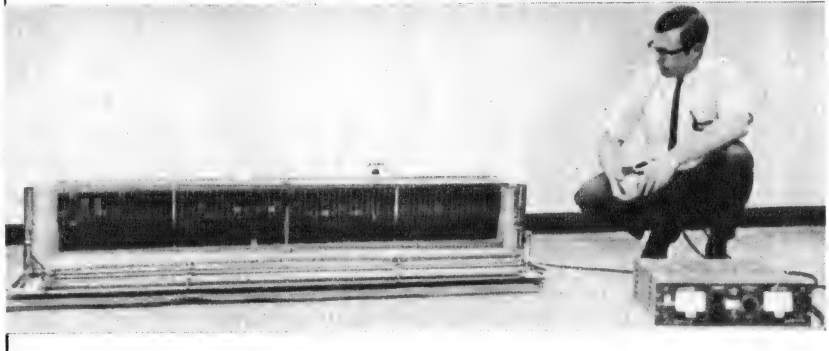
The system, called the "Flat Pack Flexible Solar Cell Array" uses a concept of stowing and deploying flexible solar arrays said to result in 75 per cent weight reduction over any array so far put into space. The prototype provides about 300 per cent improvement in power-to-weight ratio. The array can be adapted to a variety of space vehicle configurations "up to the multi-kilowatt level," the company claims.

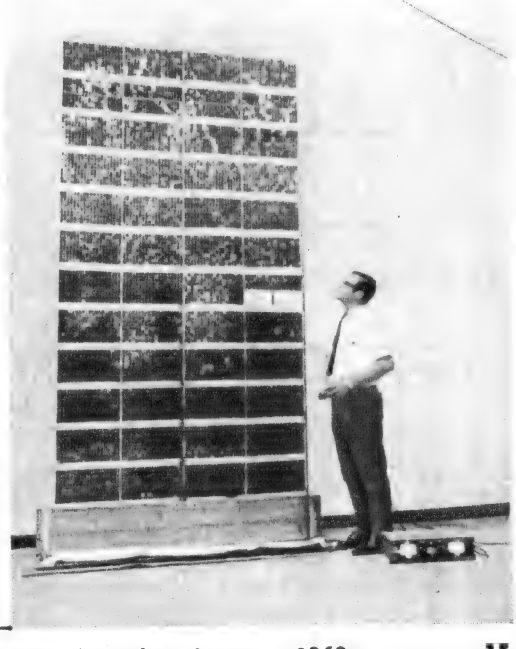
Michael Lopez, engineer in the Manufacturing Research organisation has applied for a patent on the panel fabrication. Flexible integrated interconnects are soldered to the cells, all of which are sandwiched in five cell, series-parallel hookups. In the prototype, the series hookup produces 28V, but this can be increased, Lopez said. Each 28V module has 380 solar cells.

Much of the weight reduction results from using a thing substrate on which solar cells are mounted. Another advantage in using the thin, transparent substrate ("Kapton") with integral printed circuits is that it permits the solar cell assemblies to be inspected and repaired at any time up to launch.

Possible arrangements suggested for the system include a retractable model for stowing on a flat spindle the portion of the array not needed to provide power (if some components on a vehicle should be shut down for a time; This feature also permits gradual extension of the array to compensate for radiation degradation of the solar cells, eliminating the necessity to dissipate excess power provided at the beginning of array life. Another method has fewer components, and can be used when retraction is not needed. In this configuration, the array is folded into a box panel-by-panel, rather than wound on a flat spindle.

The principal advantages of winding the array panels onto a flat spindle are: less flexure of solar cells and their interconnects; approximately 60 per cent less stowed volume.





ABOVE: R. Crawford Byzbee, associate engineers at Lockheed Missiles and Space Co., prepares to demonstrate the prototype of the new flexible solar-cell array in the flat-pack configuration. The array is in the fully retracted position.

RIGHT: Driven by an electric motor, the flexible array has been extended to its fully operational position. In this position, the unit can deliver 30W of power per pound weight of array.

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Private Commercial Stations to be Licensed

After 33 years of state monopoly in broadcasting, the New Zealand Government has decided to allow the operation of broadcast stations by private enterprise. This article from a New Zealand contributor outlines the background to this decision and the events that led up to it. The author has strong views on some aspects of the subject, and the editor wishes to point out that these do not necessarily coincide with the views of "Electronics Australia."

by B. S. Furby, M.N.Z.E.I.

If Australians experience more interference on their broadcast band in the future, it will probably be the result of new legislation just passed by the New Zealand Parliament. This is an Act to end the 33-year-old state monopoly in both commercial and non-commercial broadcasting in New Zealand by creating a Broadcasting Authority to issue licences to private stations. Television will, for the present, remain a state monpoly outside the new Authority's control.

This omission is only one of several in an Act which can be criticised as much as the present broadcasting and television services can. Any genuine attempt to create an effective authority on the lines of the U.S.A.'s Federal Communications Commission has been evaded in several program or administrative aspects on one hand, and on the other by what appears to be a complete failure by the politicians to realise that in legislating for broadcasting, they are also legislating for a highly technical medium.

Representations by the N.Z. Electronics Institute to give the Authority power to demand compliance with technical standards such as audio frequency range, noise and distortion limits or linearity have been disregarded. (The N.Z.E.I. is New Zealand's only national organisation in electronics, with membership open to all in the country in the electronics field). The new Authority may levy private stations for contributions to art, such as at present is encouraged by N.Z. Broadcasting Corporation patronage, but again the request of the N.Z.E.I. that levies also be permitted to support the Corporation's work in electronic aspects of broadcasting research was ignored in the framing of the Act.

Despite these unsatisfactory aspects of the new Act, it is at least a step in the right direction — a partial freeing of an important communication and entertainment medium from government control and civil service administration, which has been criticised by many for bureaucracy and mediocrity. It must be admitted that under these conditions broadcasting in New Zealand has provided a good program standard and a country-wide coverage, but it has not established any reputation for enterprising broadcasting.

Broadcasting in New Zealand was not always a government monopoly— the country did have an independent Broadcasting Board once, and a number of private stations. However, on its election in 1935, the first Labour Government set up a state department to administer broadcasting. The Board and most of the private stations were taken over at that time. The change did have some merit, in that private stations with limited facilities were able to give an improved service with the resources of a national organisation hehind them.

Faced with a hostile press, Labour's next adventure in the broadcasting world was to create a commercial broadcasting government department to operate in competition with the existing non-commercial network. War economies forced an amalgamation however, and the N.Z. Broadcasting Service resulted, running both commercial and non-commercial services. (One private station survived the takeovers: 4XD Dunedin, run by a local radio society and subsidised by the state organisation.)

Shortwave broadcasting, which had been pioneered by a private station, also fell to state control during the war. Two 7.5KW transmitters were provided in the immediate post-war period for better service. Although Cabinet approval has been given to replacing these with 20KW units, there has so far been no move to do so.

First step along the way to liberalising broadcasting was taken in 1962 by a National Party Government (Labour having been relegated to the Opposition). This was to form a government-appointed N.Z. Broadcasting Corporation to take over the state department of broadcasting.

Significantly, the Corporation's Director-General remains outside the Corporation's appointment. He is appointed and paid by Parliament.

The Corporation was given power to grant a private station licence to any applicant who could succeed in proving inadequate service: in a small country of 2½ million people and 47 stations, no one appears to have proven a case yet. Perhaps the Corporation's methods are not always helpful: one would-be applicant, on asking the Corporation how he should set about applying for a licence, received the answer that his application had been considered and refused!

In such an authoritarian atmosphere, and with frequent resignations of creative staff (to the accompaniment of newspaper headlines hinting at political interference) public opinion tended to be dissatisfied with the N.Z.B.C. Unfavourable comparisons with the enterprising B.B.C., and its freedom from political control (the B.B.C. has the power to refuse the British Prime Minister the microphone) contributed to the general dissatisfaction and led to demands for more freedom in broadcasting.

Meanwhile, television had come on the scene (somewhat later than in some of the "under-developed" nations New Zealand taxpayers contribute to through aid programs). As far back as 1949, a state department committee had begun studying television, though its findings were used mainly by the Government to claim the cost as prohibitive and an impossible drain on the country's precarious balance of payments situation. It was left to private

The fine modern building in the foreground is the Wellington headquarters of the New Zealand Broadcasting Corporation. It contains the studio facilities for the five Wellington broadcast stations.

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enterprise to introduce television, as private enterprise had in the beginning introduced broadcasting, and later shortwave broadcasting.

An Auckland manufacturer, Bell Radio, used their experimental licence to radiate programs with entertainment value. Once Aucklanders invested in television receivers and had a taste of viewing, the Government could not clamp down, it could only — with reluctance — authorise the N.Z.B.S. (as it then was) to go ahead. This was in 1958.

Even with a service approved and working with low power transmitters in the four main centres, the state broadcasting department continued to be led by the noses by private enterprise. Private (and illegal) translators mushroomed as country viewers banded together to provide extensions to the early limited coverage and these were so successful they had to be legalised, despite outraged authority.

The N.Z.B.C. now has a 100KW transmitter for television in each of the four main centres, and others of equal or otherwise adequate power to spread the coverage over most of the country. The four regions each have one program, so only one channel is available to a New Zealand viewer. Advertising is included four evenings a week. Sunday (as with sound radio) is one of the days free from commercials.

The N.Z. Radio and Television Manufacturers' Association, at its annual conference in October, reaffirmed its priorities: First, a second television channel; second, colour television; and third, FM broadcasting. Government reply — reputedly on N.Z.B.C. advice — is that a second channel should be in colour, but it should be introduced nationally. Because of limited national resources, this would be delayed until at least 1972.

Since televisions station licensing is excluded from the scope of the new Broadcasting Authority (it will deal exclusively with sound broadcasting) there is no chance of a commercially operated second program before 1972. The N.Z.B.C. still has a head start, however, as the Authority cannot delicense any existing N.Z.B.C. station. The N.Z.B.C. staff, through their staff association, have publicly said they are not afraid of competition, and would find it challenging if of a high standard. As, despite their working for a Corporation, their salaries are tied to the state services salary scale, they may well be ready to welcome the employment opportunities competition will also bring.

New Zealanders of today have already had a taste of the vitality and enterprise of private broadcasting, through the activities of the "pirate" station, Radio Hauraki, which operates from international waters, in the Hauraki Gulf, off the coast of Auckland. If ever a Government was embarrassed by attempts to run with the hare and hunt with the hounds, Hauraki has done this to the N.Z. Government. Half-hearted attempts were made to stop Hauraki's first ship from putting to sea, but these met with such a public outcry that Ministerial direction has required state departments concerned (Marine and Post Office) to temporise ever since. Although apprehended while transmitting within the three-mile limit, only a nominal punishment was imposed for a breach of International Regulation 190. This is in direct contrast to the wrath visited on previous pirates attempting to operate on the amateur and other bands.

Simultaneously with the passing of the Broadcasting Authority Act, another one, the Post Office Amendment Bill (No. 2), was passed by Parliament, giving the Government some teeth to put down unlicensed transmitters. The legislation has written into it a delay to allow Hauraki to apply for a licence before the Act comes into force.

The press, meanwhile, has enjoyed the Government's dilemma over Hauraki. Should the pirates have been licensed ahead of other would-be private broadcasters who did not set up unlicensed transmitters? How else to reward the pirates for their undoubted initiative and enterprise, when they were bucking a system rather than breaking the law the way a criminal does? Because even though it panders to the teenage segment with its pop music, Hauraki is another example of private enterprise giving the lead to government agencies.

One N.Z.B.C. station in each of three main cities was hurriedly changed to a teenage program format to cater to the audience potential Hauraki had uncovered. More dramatic — if less publicly known — was the change in the face the N.Z.B.C. is presenting to advertisers. Hauraki works to attract advertisers with the sort of service Australian competition knows only too well, and the N.Z.B.C. was suddenly stimulated to try a little harder to please paying customers. Hauraki still has the edge when it comes to service, however, and it is unlikely that an organisation with a civil service background will change its way of life within a short period of time.

One sin of Hauraki's has been attended to in the new Broadcasting Authority Act. Sundays will continue to be free of advertising on radio, so licensing Hauraki will put a stop to its transgressions against one of New Zealand's ingrained customs.

The Labour Party has not been silent throughout these changes to its socialised broadcasting. Threats to take over private stations without compensation have become its declared policy should it become the government again, but it is similarly out of step with public opinion in other matters also, so on present indications a change is not likely in 1970, when the

Continued on page 142)

New TV Centre for U.K. Midlands

A project for a $35 million entertainments centre in the heart of Birmingham (the largest industrial centre of the English Midlands) has been announced by the commercial television company, Associated Television Corporation. The picture above shows a model of the complex. Called Paradise Centre, it will stand on a six-acre site and will contain a television studio, an exhibition/conference/banquetting hall, a theatre, twin cinemas, a hotel and restaurant, and neighbourhood shops. The site will be dominated by a 300ft high office block and the hotel, which will be designed to offer accommodation in between 250 to 300 bedrooms.

The top storeys of the office tower will accommodate a rooftop restaurant and kitchen, which will be serviced by high-speed lifts travelling at 800ft a minute. The television area will have three major production studios with their ancillary accommodation, a viewing theatre, rehearsal rooms and a base for outside broadcast units.

Associated Television is one of the program contractors who operate commercial television channels in U.K. These contractors provide their own studio and production facilities, but hire their transmitting equipment from the Postmaster-General's Department. The P.M.G.'s Department is responsible for the technical aspects of transmissions from the point where signals leave the studios.

Electronic Speech—Recognition System

Last month, we described printed-character recognition machines developed by the National Physical Laboratory in the U.K. Scientists at the same establishment are currently working on the design of machines intended for direct mechanical speech recognition.

The National Physical Laboratory in the U.K. is organised into three groups — Measurement, Materials and Engineering Sciences. Each year, just one of them exhibits its work at the laboratory's "open days": in 1967, it was the Measurements Group, and in 1968 is was the turn of the least homogeneous of the three, Engineering Sciences. The group covers ships, hovercraft and aircraft and their underlying fluid dynamics; the aerodynamics of buildings; and, on a completely different tack, a McLuhanish range of studies spanning the spectrum of information-processing, from computergrid research to human speech and senses.

At the human end of the spectrum, we find the print-reading systems described by J. R. Parks and D. A. Bell in the article "The 2-ness of the 2." ("Electronics Australia," December, 1968.) Even more human in its associations is the work aimed at direct mechanical speech-recognition.

A single phoneme, recognised by the human brain as a simple entity, is, in fact, quite a complex collection of frequencies, of various strengths and durations. We have no difficulty in extracting from this mass of information the unvarying pattern that is the essence of the vowel or consonant (although it helps if we know from the context whether the speaker is from Kensington, Sunderland or Austria). To make a machine do the same thing entails first finding out what the unvarying pattern is.

At the National Physical Laboratory, speech recognition work is concentrating for the present on vowels. It is considered that the recognition of vowels is about as complicated as doing the same with consonants, and the latter task is apparently being undertaken elsewhere in the U.K.

It has long been suspected that the information in speech is carried in the form of the frequences of resonant cavities. This information could be in the frequencies themselves, or in the ratios between them, or in some combination of the two.

What is done at NPL is to operate on the waveform itself, with a battery of eight or so filtering techniques. For example, in a particular vowel, a high-frequency component may show up only at the peaks of a lower-frequency wave: in such a case it is possible to set up an electronic system to identify this high-frequency constituent whenever it appears.

The work so far has been largely a matter of finding just what pattern, in "frequency-space," is always present when a particular vowel is spoken. The progress made is evident from the fact that the researchers have managed to map out nearly all the simple vowels (not the diphthongs) in a two-dimensional space, of which one axis represents the frequencies below 800Hz and the other the remaining frequencies. This sort of plot reflects the finding that a vowel can be to a great extent characterised by a particular combination of a high frequency and a low one; the degree of variation possible between manners of speech, as regards both the frequencies used and the ratio between them, is covered by assigning to each vowel an area, rather than a point or line, on the frequency-frequency map.

The experimental set-up shown in the photograph is adapted to distinguish words of the small set "but, boot, bit . . .", and so on for the rest of the vowels. In the present arrangement, when one of these words is spoken the corresponding light comes on above the logic cabinet on the left of the picture. The electronic processing is, compared with the speed of speech, effectively instantaneous, so that time-sharing becomes a distinct possibility, reducing the cost per speaker. An advantage claimed for the system is that duration is one variable that plays no part; thus the rate of speaking does not matter.

In this sort of work, the question of regional accents is often said to present an almost insurmountable barrier. One man's "hat" is another man's "hut," so how is the machine to know which is intended, even if it has succeeded in hearing the vowel correctly? The NPL team is by no means pessimistic on this question, for two reasons. First, they find (surprisingly enough) that, given a good vowel-recognition system, regional differences as heard by the machine are less marked than they sound to the human ear. The second point is that, provided the vocabulary used is limited to a few hundred words, ambiguities need not arise. Different regional versions of the same word can usually, it is thought, be handled as different words at the input end of the machine, and then treated as synonyms by a final logic stage. Ambiguity begins to become a problem only when the vocabulary is made larger and therefore contains more possible meanings. If regionally different versions of any two words happen to sound the same, it should, in principle, be easy enough to sort them apart by providing the machine with a grammatical or contextual logic stage.

But this is looking some distance into the future. For the moment, there is considerable interest in machines that can simply recognize the spoken numerals. There are some obvious applications, as, for example, the sorting of mail according to a post-code system. A great deal of manpower could be saved if the sorter could simply read the code into a microphone and leave a mechanical sorter to do the rest. Another application — resting on the same experimental finding as the first, namely that numbers can be spoken four times as fast as they can be typed, and more accurately — is in telephony. A speech-recognizing system would not only save time but, more important, would avoid one major source of "wrong numbers." ■

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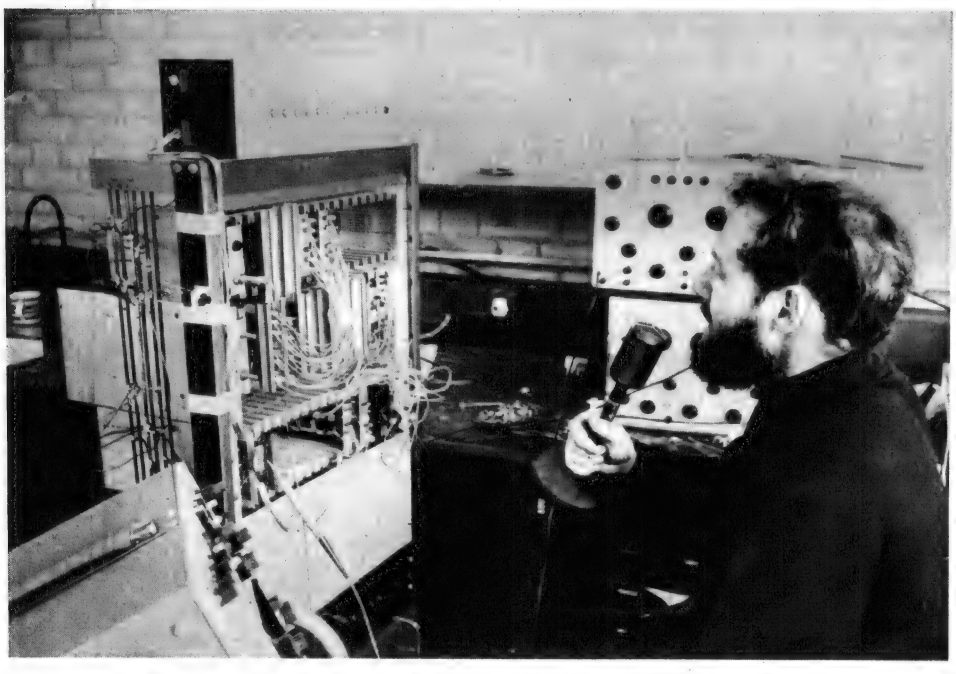

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Technical Review

Low-cost Plastic Laser Tested by U.S. Scientists

What may be a major breakthrough in the laser field is reported by scientists of the Raytheon Company, who have succeeded in making a laser using a virtually worthless piece of plastic material as the lasing element.

Fluorescent colours — those bright, vivid reds, greens, and oranges—have been around for years. The military uses them to make aircraft more visible and fluorescent dyes make the uniforms of downed airmen easier to spot. On the homefront, fluorescent ink appears on almost every bumper sticker and innumerable advertising signs.

Now, two Raytheon Co. scientists have built a fluorescent-red plastic laser that may presage devices that would be the cheapest lasers yet, and would require little input energy to lase.

Michael N. Bass and Thomas F. Deutsch, research scientists at Raytheon's laser advanced development centre in Waltham, Mass., hit upon the idea in the course of work on liquid, or dye, lasers. They had tried mixing fluorescing dyes in plastics to see if they would work as well as they had in solution, but without much luck. They did notice, though, that the colour of fluorescent red acrylic plastic almost exactly matched one of the dyes used in their liquid laser experiments, Rhodamine B.

So they invested $4 in an 18 x 48in sheet of quarter-inch plastic, cut off a corner, and, using light from another laser as a pump, tried to make it lase. It did—very well, in fact.

They then cut from their slab of plastic a laser "rod" ¼ by ¼ by 4 inches. Its end faces were only roughly parallel and it was hand-polished at that, but when it was pumped with a quick-rise-time flash of light it worked like a charm.

Their discovery is so new they haven't had a chance to make accurate measurements, but Bass and Deutsch estimates the rod's gain at about 15 per cent per inch. This compares well with the figure for the far more common—and costlier—ruby laser rod. And the pump energy needed to trigger lasing is only about six joules; an equivalent ruby rod would require about 100 joules, the researchers say.

But best of all, the plastic laser is inexpensive. The two scientists estimate that the 4-inch rod drew no more than 3 cents out of Raytheon's research fund. With a basic material this cheap, they feel it might be possible to build solid state lasers at as little cost as gas lasers. But even if it was only competitive in price, the plastic laser would probably be more rugged than the delicate glass helium-neon lasers, and could carve a place for itself in the small but growing market for laser alignment tools. It might also find use in battle field communication systems or range finders.

But some problems must be solved before plastic devices can challenge other types of lasers. For one thing, commercially available plastic is of poor optical quality and can't generate the kind of finely collimated beam produced by crystal or gas systems. More importantly, there's a problem in getting plastic that will lase dependably; the amount of fluorescent dye in commercially available acrylics varies from lot to lot, and sometimes there isn't enough for laser action.

And, for some unknown reasons, commercial plastic rod stock doesn't lase at all, though its dye concentration appears to be about the same as that of sheet stock.

It would be ironic in an age in which fluorescent colours brighten everything from billboards to costume jewellery, but Raytheon may have to invest in a chemical facility of its own to overcome these problems. The plastics industry is geared to volume sales, not custom jobs. Bass and Deutsch have even had trouble getting single sheets of stock items, and they've often had to content themselves with leftovers from warehouse lots.

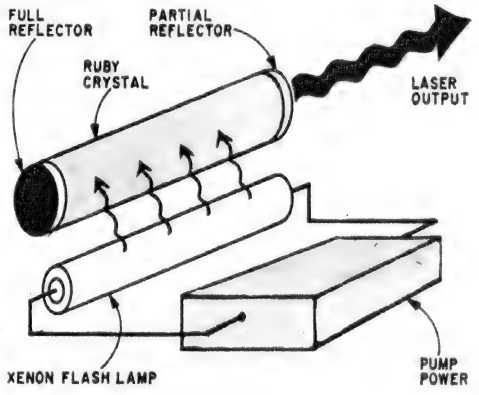
But they haven't been squelched by this. Instead, they've begun searching for other new laser materials which, like fluorescent, may have been under their noses for many years. ("Electronics," 16/9/68.) ■

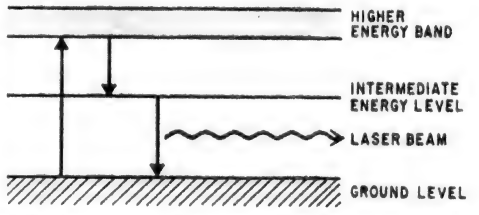
What makes a Laser lase?

A typical laser system is built around a rod of active material, such as ruby. Both ends of the rod are optically polished to produce a flat surface; one end is coated with a material that totally reflects light, the other with a substance that only partly reflects light. The light that is reflected at this end sustains the excitation; the light that isn't reflected forms the laser beam.

The source of ordinary light, commonly called the pump is usually a xenon flash tube. This light, which is directed on to the rod, raises the atoms in the ruby crystal from minimum energy ground level to a band of higher energy. These energy levels depend on the characteristics of the active material.

The atoms then drop from this high energy level to an intermediate energy state. Then they return to the unexcited state and it is when they make this last transition that they emit light of a certain wavelength. The wavelength, like the high-energy level, depends upon the material used. ("Electronics," 19/8/68).





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Input:	Mag-Phone 3mV, Extra 200mV, Tape-in 200mV for maximum output.
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Weight:	18 lbs.

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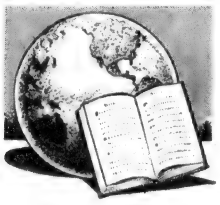


TROPOSPHERIC SCATTER RESEARCH WITH LASERS

New techniques developed to study the effects of tropospheric scatter of VHF and UHF signals, by artificially recreating on a miniature scale the conditions which give rise to it, are expected to greatly assist communication systems engineers, to whom the effect is desirable and to television system planners, to whom it is not.

The search for knowledge about over-the-horizon propagation is an urgent one for television broadcasters, because there are only a relatively small number of channels available for television services.

If VHF and UHF signals travelled only in straight lines as far as the horizon there would be no problem. As to the reasons why they do not, it is known that the signals are transmitted over the horizon by "ducts" in the troposphere formed by temperature inversions; by scattering from areas of the troposphere where turbulent effects are occurring and where the refractive index is therefore varying very rapidly; and also by diffraction over hills. It has even been suggested that the downrushing cold air associated with thunderstorms can form ducts close to the earth's surface, which will greatly increase interference between stations when there are thunderstorms about.

It is the precise details of these ducts and scattering mechanisms that have so far eluded scientists and engineers working in this field. However, a number of leads are being followed up and some interesting models of the troposphere, which can be used to try out on a small scale the theories that have been put forward, were described at a recent Institution of Electrical Engineers conference in the U.K. on the subject. In one paper a French scientist described work that has gone as far as producing a formula for accurately determining the strength of signals scattered from high up in the troposphere.

A laser model for investigating scattering effects was described by R. E. Post and D. F. Rost of Iowa State University. They pointed out that the reason why few of the theories advanced to explain the observed phenomena have been successful is probably that they are based upon mathematical models that are gross oversimplification of the physical situation they are supposed to describe. This over-simplification has been necessary in order to solve the problem mathematically. What is really needed, said these two scientists, is a laboratory model in which experiments can be carried out to test specific propagation mechanisms.

One of the principal difficulties facing anyone trying to build such a model is that of controlling the "atmosphere" so that only the desired scattering and other mechanisms are present. This is largely a question of size; the "atmosphere" can be controlled accurately enough if the model is made small enough. The answer they have found is to use a helium-neon laser operating on a submicron wavelength as the basis for a model that has a scale factor of over one million to one. The earth is represented by a glass disc ground to form part of the surface of a sphere with a radius of 5.5 meters. With a laser wavelength of 6328 angstroms the model is equivalent to a tropospheric communications system on the real earth working on a frequency of 416MHz. The characteristics of the glass at the laser wavelength are very like the characteristics of the earth in an area of poor sandy soil. Photographic film is used to record the received signal, from which detail of the received field strength are then obtained by scanning the negatives with a high precision recording microphotometer (which has a slit width of 10 microns and a slit length of 100 microns). A dynamic range of measurements of about 100dB (a factor of 10^{10}) is possible using several films, each separate film having a range of about 8dB.

Scattering centres are generated by dropping a large number of very small glass spheres through the transmitted beam. This produces just the sort of random over-the-horizon fields that one gets with a real tropospheric radio propagation system. The beads were solid glass spheres ranging in diameter from 125 to 177 microns. Large numbers of beads were needed for the propagation of scattered fields typical of those found in radio systems. This seems to confirm that large numbers of scattering centres do play a part in natural over-the-horizon radio propagation through the troposphere. The great advantage of this new experimental technique is that various types of propagation path can be fabricated at low cost to try out new ideas.

Hills and mountain ranges are also responsible for over-the-horizon reception of UHF and VHF radio waves. Here, effects such as the knife-edge diffraction effect well known in physics can occur at sharp ridges. These, too, can be investigated with a laser model. A B.B.C. engineer, K. Hacking, has been using such a model to investigate the effects of hills, and he described models constructed to simulate flat-topped, thick slab and double humped hills.

An idea of the size of the scattering centres in the troposphere was given by P. A. Matthews and S. Defu of University College, London, who have been making measurements at a site at University College on the signals from the Independent Television Authority transmitters at Mendlesham and Lichfield, which are 116 and 170 kilometres respectively from London. Each centre, they said, appears to have dimensions of a few hundred metres.

Some knowledge of the exact nature of the mechanisms that reflect VHF and UHF waves over the horizon is thus beginning to appear, and the laser laboratory models described should greatly help the search for further information. ("New Scientist," 17/10/68.) ◻

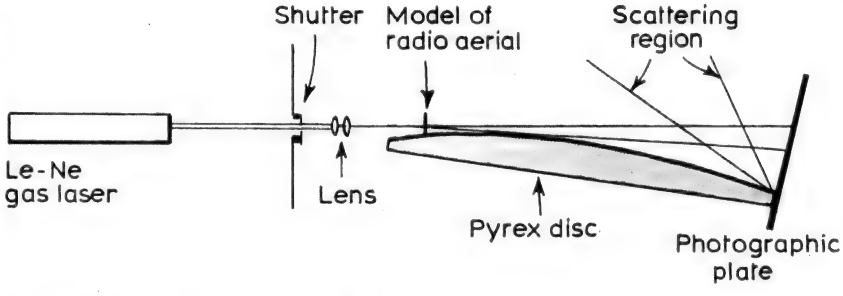
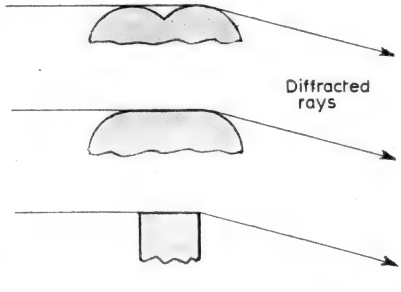


Diagram of a laser model for investigating tropospheric scatter propagation of VHF and UHF signals. The scale factor of the model is over a million to one.

BELOW: Some of the shapes used by the B.B.C. in their scale model tests.



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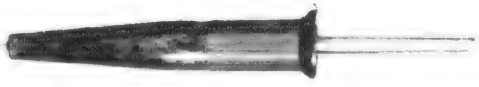

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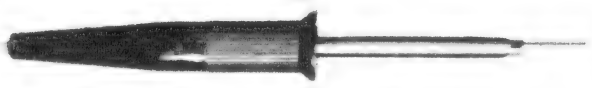

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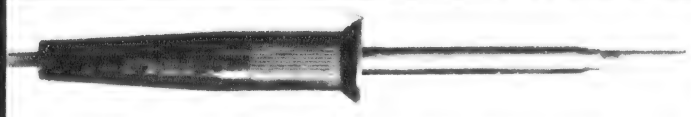

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INDUSTRIAL INFRARED TV CAMERA USES NIPKOW DISC

From Mullard Ltd., England, comes a description of a closed circuit infrared television system employing one of the oldest television systems known — the Nipkow disc scanning system. The original story is quite long but the following is a precis featuring the most interesting sections.

Closed-circuit infrared TV systems have a number of industrial and medical applications. Some of the more obvious are monitoring furnace walls or lagged pipes to detect faults; detecting hot spots in electronic circuits; measuring skin temperatures in medical applications where the condition of the patient is reflected in the temperature of the skin.

A number of very expensive thermal scanning systems with high optical definition are commercially available. These systems, however, are generally bulky, not portable, and require large power supplies. Many of them also have the disadvantage of taking a long time to generate a picture.

The object in building the prototype scanning system described in this article was to determine the performance of a lightweight inexpensive camera employing the simple Nipkow disc as the scanning mechanism.

This mechanism comprises a flat disc, perforated with a spiral of holes which, when rotated, generates scanning lines. Since the disc, rotating at 1000rpm, is the only moving part, the camera is small in size, robust and has a low power consumption.

Nipkow disc scanning is a means of scanning in the image plane. The disc has a spiral of 30 holes around its circumference each of which scans across the image in turn. The radiation passing through these holes is focused on to an infrared detector. The signal from the detector is then used to intensity-modulate the raster on the display oscilloscope. Secondary holes diametrically opposite the scanning holes are used to give pulses with which the line and frame timebases providing the raster are synchronised. The synchronisation pulses are produced by using a 12V festoon bulb and two BPX25 silicon phototransistors.

The scanned image size on the Nipkow disc is approximately 1.5 x 1.5cm. The 30 scanning holes are placed on radii of the disc, such that angular displacement between any two consecutive radii is the same. Partly to compensate for the fact that the drilled scanning holes are round rather than quare and partly to increase the temperature sensitivity, the scanning lines were made to overlap by 50 per cent on both sides. Each hole is 1mm in diameter.

A problem concerning the Nipkow disc — particularly one intended for use with the more sensitive types of infrared detectors, such as the indium antiminide type — was that the first discs produced a large spurious signal when rotated. The amplitude of this spurious signal was up to 50 times that of the noise from the detector and was caused by variations in reflectivity and emissivity, and by wobble along the surface of the discs. Various metal discs were made with polished or matt surfaces but, although the spurious signal was reduced, it was still much greater than the detector noise.

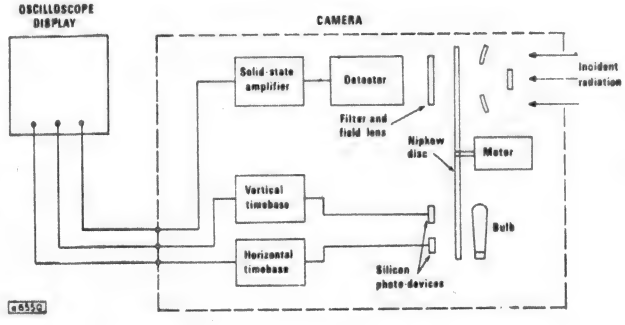
Finally, a different principle was tried. A disc was made of clear Perspex which, in thin sheets, transmits infrared out to 5.5μm. This disc was found to produce a very low spurious signal. Because most of the radiation is emitted from beneath the surface of the disc, surface imperfections and small scratches did not cause high standing signals as the disc was rotated. One problem that occurred on using clear Perspex, however, was that radiation from the bulb driving the phototransistors was channelled through the disc to the scanning holes, where it interfered with the video signal. This was overcome by using black Perspex.

The requirements of the equipment are that it should be portable and relatively inexpensive. This dictates the requirements of the optical system. A germanium lens could be used instead of the simple reflecting Cassegrainian system employed, but this would be expensive and therefore conflict with a basic requirement. The Nipkow disc scanning system, although not theoretically the most efficient, has the advantages of mechanical simplicity and ease of manufacture.

The radiation from the scene is collected by the front - silvered concave mirror, focused via the front-silvered plane mirror onto the Nipkow disc spiral of holes. Each hole scans the image in turn, and the transmitted radiation is focused onto the annular detector by means of a field lens. The field lens projects an image of the effective annular shape of the collecting optics onto the detector element, and hence the radiation transmitted by a scanning hole is uniformly spread over the detector area.

The detector is a Mullard 77 K indium antimonide photoconductive infrared detector which has an annular element to match the optical system. Cooling is required for this component and this is achieved by using a liquid nitrogen drip-feed system supplied from a dewar vessel placed on the ground at the side of the camera. This enables the camera to be operated in any plane.

With a 30 line, 17 frames per second picture, the equipment has a temperature sensitivity of 0.5°C with a room temperature background. Thus, it can detect the presence and position of any 'hot spots' on moving and stationary objects within the field of view.



Block diagram of the infrared TV system. Note the novel method of generating the time base pulses.

If a Mullard room - temperature lead sulphide detector is used in place of the indium antimonide detector, the minimum detectable temperature becomes 120°C but detector cooling is then unnecessary.

These cameras . . . (using the two types of detectors mentioned) . . . have the advantage that they can continuously monitor the movement of hot objects and the heat flow in stationary objects. The portability and battery operation of the cameras have proved very useful.

Both cameras have been used in industrial and medical applications, for the early diagnosis of problems ranging from the detection of flaws in the walls of glass furnaces and hot electronic components on circuit boards, to the examination of patients for cancerous growths and "heat flow" in varicose veins.

The fact that most oscilloscopes can be used as the display for the cameras could be very useful in a large number of research projects where an inexpensive, versatile infrared camera is required to examine a problem. If, however, accurate temperature measurements and location of objects within the field of view are required, then it is possible that a display in which more information is presented would be necessary.

(Continued on page 136)

University

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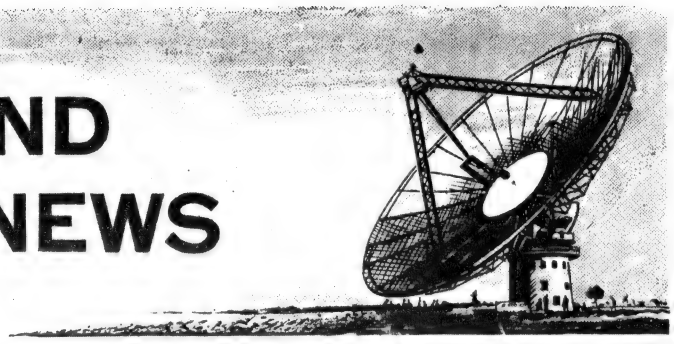


Weather communications

A weather message-switching system is to be constructed in Kansas City, U.S.A., for the U.S. Federal Aviation Agency, by the North American Philips Company's Communications Systems Division. The system is designed to collect and exchange weather reports, forecasts and other related data through a national network in support of local, aviation and military weather services. It will also provide for the handling and dissemination of similar data for international sources. When completed, it will include five interconnected high capacity processors capable of communicating on approximately 500 low- and high-speed circuits. The information will be displayed on cathode ray tubes and/or teletypewriter.

The heart of the system is a Philips DS-714 communications computer designed specifically for communications used in a real-time on-line environment. It completely automates message switching functions by storing and forwarding, and performs all polling, collection, selection and redistribution functions vital to the system. Weather reports will be collected on a scheduled basis, assembled at the central facility into inclusive reports, and distributed according to a prearranged pattern and schedule. Some stations have the ability to make random queries for specific information stored in the processor's memory.

Cassette data recorder

A cassette-loaded data recorder to store some 22 hours of data on a standard 10½in magnetic tape reel has been developed for the U.S. Air Force by Lockheed Electronics Co., Plainfield, New Jersey. The recorder is intended for the C-5 Galaxy's MADAR (malfunction detection, analysis and recording) system. The recorder takes incremental steps of .0018in of tape at a time at a rate of 200 steps per second to pack up to 556 bits per inch. Weighing 36 pounds, the recorder includes a unique stepper motor with no gear backlash and command-control logic electronics with a minimum of interface lines and controls .

Laboratory exhibitions

LABEL International 1969, an exhibition of laboratory apparatus and materials, will be held at Earls Court, London, from March 25 to 29, 1969. Sponsored by the Scientific Instrument Manufacturers' Association of Great Britain, the exhibition will include a program of lectures. Abstracts of these lectures will be available at a later date. Further information may be obtained from Bevan M. Gilpin, Press and Publicity Officer, LABEX International 1969, UTP Exhibitions Ltd., Racquet Court, Fleet Street, London EC4, England.

Radiotelephones for New Guinea

The Posts and Telegraphs Department of Papua/New Guinea has ordered 30 additional VHF radiotelephone units for use in remote subscriber networks. The radio telephones, to be supplied by Philips Telecommunications, will form the basis of three new networks at Port Moresby, Rabaul and Lae, bringing the total number of networks in operation to six. The radio telephone subscribers equipment gives plantation owners, settlers and industrial organisations in remote areas, where the installation of normal telephone lines is not possible, the facility of the normal telephone service.

The exchange equipment comprises a standard Philips 50W FM transmitter/receiver base station to which the special selective calling equipment is connected. The selective calling equipment employs a simultaneous multi-tone transmission method of coding. The equipment is designed for connection to any standard manual telephone exchange.

Standards for broadcast stations

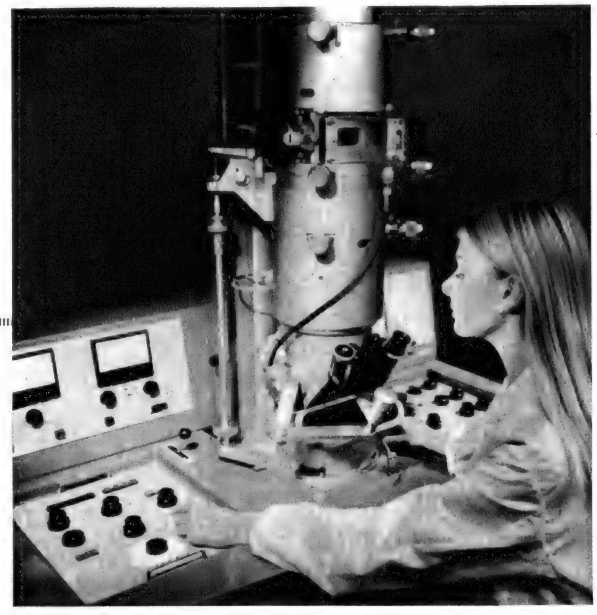
The Australian Broadcasting Control Board has determined new standards for the technical equipment and operation of medium frequency broadcasting stations. The new standards have been framed in the light of technical developments in the broadcasting field and experience in the application of the original standards. Prior to determining the new standards, the Board took into consideration comments on the draft of the standards invited from interested parties. The standards have been issued to broadcasting stations and other sections of the industry directly concerned with them.

British pay TV finishes

The British Government in 1960 decided to permit an experiment, to last for some two or three years, in pay television transmitted solely by wire, but expressly without guarantee that a general or permanent pay television service would be authorised on the conclusion of the experiment. Licences were granted to three companies in 1964, but two of these later withdrew. The remaining company, Pay-TV Ltd., began an experimental service in parts of London, and in Sheffield, in 1966.

Announcing the closure, the Postmaster-General told the House of Commons: "In May, 1967, the company asked my predecessor to consider sympathetically their proposal that the service should be explained on a non-exclusive footing. Since then there have been a number of exchanges with the company. In August, 1968, they suggested that the service should be expanded to cover 250,000 in London and 1,800 in Sheffield. The Government has reviewed their proposals in the light of the company's representations and of experience of the service. As a result of this review, and bearing in mind wider economic and social considerations, I have decided that no extension would be justified and that the experiment should be terminated."

British electron microscope



A technician adjusts the controls of the EM802 electron microscope, one of a series of high-resolution microscopes produced by G.E.C.-A.E.I. (Electronics) Ltd., Harlow, Essex, England. The EM802 has features of particular value for metallurgical and crystallographic studies. It has twin sets of controls that allow programmed switching from bright to dark field image or between two selected dark field orientations. It also has an automated vacuum system that is push-button controlled.

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Accuracy, measurement capability, and low cost have been a long time coming in the multimeter field. Now, they're here with the introduction of the new Fluke 853A. ☐ These specs are guaranteed for one year without recalibration. DC volts 0.2% AC volts, 0.5%. Range, 0 to 1.1 kv. DC amps, 0.2%. AC amps, 0.5%. Range, 0 to 11 amps. Ohms, 0.2%. Range, 0 to 110 megohms. All this plus complete overload protection. ☐ Does this data bit give you just a hint why we also call the Fluke 853A, "the only complete multimeter?" Write or call for complete information.

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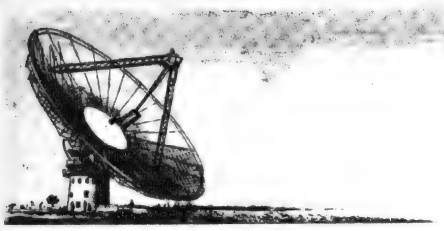

Stereo cartridges from Japan

Tokyo Shibaura Electric Co. Ltd. (Toshiba), Tokyo, Japan, is to export in 1969 two newly-developed stereo cartridges, the C-100P OPTI photoelectronic cartridge and the C-300F MINI integrated circuit (IC) cartridge. Full information is not available, but a limited description released by Toshiba says that the C-100P operates on the principle of converting stylus vibration into electric signals through light beam deviation using photo transistors. The cartridge will be sold with a specially designed preamp containing a built-in stylus pressure indicator.

The C-300F uses a miniaturised piezoelectric generating element with an IC to convert the element's output to a low impedance to reduce line losses. This cartridge wil be sold only as a part of a stereo player.

British Post Office Bill

The 230-page Post Office Bill, to turn the British Post Office into a public corporation, represents the biggest legislative task ever undertaken by the Post Office. A great deal of the Bill is concerned with the necessary changes to existing Acts of Parliament. This has meant a meticulous analysis of all the Public General Acts (back to the days when they were written in Norman French), and a great many local and private Acts as well, to find all references to "Postmaster-General" or "Post Office."

In addition, minute attention has had to be given to the Post Office's own Acts. The Post Office Act 1961, which gives the Post Office its present financial status, is largely repealed. Other Acts have had to be adapted to allow the new authority to work under them. For the research, the Post Office created a special team of solicitors and administrators who have worked on it for over two years in parallel with the Parliamentary draftsman.

Datel 2400 system modems

Standard Telephones and Cables Ltd., in U.K., is supplying nearly 10,000 modems (modular-demodulator units) for the British General Post Office's "Datel 2400" system. This system is a public data transmission system to be operated by the G.P.O., capable of dealing with 2400 binary bits a second in the form of tone signals. The modem converts the digital information into the tone signals for transmission over landlines. Here, a technician is assembling a main circuit board for one of the modem units.

Wind-finding radar

An operator sights the tripod-mounted free-standing version of the Plessey WF3 wind-finding radar on to the target balloon by using a remote control unit. When the finder is on target, the operator switches to "autofollow," after which operation is largely automatic. The equipment provides a full flow of data available to a height of 100,000 feet in the tropics and to at least 80,000 feet in higher latitudes. The WF3 was developed by Plessey Radar Ltd., Weybridge, Surrey, England.

Communications link for Malaysia

The Telecommunications Department of the Malaysian Government has awarded a contract to The Marconi Company Ltd. for the provision of a communications link to extend across the 400 miles of the South China Sea dividing East and West Malaysia. The company is to install a two-way tropospheric scatter system to provide effective telephone and telegraph services between the two halves of the country. The system includes four 90ft dish aerials and associated 10KW terminal equipment. It will link with the microwave system in West Malaysia, and the traffic will eventually be disseminated throughout Sarawak.

Also included in the contract is a HF radio link which will be used for the transmission and reception of meteorological information for use primarily by airline operators.

Symposium on nuclear electronics

The North Italy Section and the Nuclear Science Group of the Institute of Electrical and Electronics Engineers are sponsoring an international symposium on nuclear electronics to be held at Ispra, Italy, on May 6-8, 1969. Contributed papers will be read on the following subjects: Preamplifiers for nuclear detectors; Amplifiers — shaping, DC restoration, baseline shift; Problems of time resolution; Pulse height analysers; Time sorters; Computers on line and data reduction in nuclear experiments; Statistics in nuclear electronics. English will be the official language of the symposium.

Further information is obtainable from the scientific secretary of the symposium, Prof. Luciano Stanchi, C.C.R. Euratom, 21020, Ispra, Italy.

Fault warning system

An aircraft voice warning system has been developed by the Aircraft Equipment Department of Ferranti Ltd., Manchester, England. Should a fault develop in an essential part of the aircraft, the system (type FAW. 3) gives a spoken warning through the aircrew's headsets or cabin speaker. The warning message, recorded on a closed loop magnetic tape, is repeated until the fault is cleared or the alarm is cancelled. The equipment can transmit up to 15 different warning messages, each separately triggered by an appropriate signal obtained from existing alarm circuitry.

TAB computer in W.A.

A computer complex which recently went into operation for the Western Australian TAB is the largest currently operating in the State. The system has an IBM 360/30 with core store of 32,000 characters, two IBM optical mark page readers, three IBM 2260 visual terminals, two Siemens T100 readers and two disc storage devices.

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OPM 2A	7	10000	P.P. 15, 8 3.7, 2
OPM 7A	15	(10000) 8000, 7000	P.P. 15, 8 3.7, 2
OPM 8A	15	(10000) 8000, 7000	P.P. 500, 250, 166 100
OPM10A	25	(8000) 6600	P.P. 15, 8 3.7, 2
OPM 9A	25	(8000) 6600	P.P. 500, 250, 166 100
OPM14A	35	(8000) 6600	P.P. 15, 8 3.7, 2
OPM13A	55	3500	P.P. 15, 8 3.7, 2

Impedance in brackets indicate screen taps available.

OUTPUT TRANSFORMERS

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		Hi-Fi Using Oriented Grain Steel for Mullard 5-Stereo-7 Playmaster 2 & 4	
OP412	7	9000 + Screen Taps	PP. 15 7.5 3.7 2
		Hi-Fi for Mullard 5-10 Amplifier	
OP308/15	12	8000, 6000	P.P. 15 3.75*
		Ultra-Linear	
OP301/15	12	8000 + Screen Taps	P.P. 15 3.75*
OP312/15	25	6600 + Screen Taps	P.P. 15 3.75*
		For 6GW8's (ECL86's)	
OP447/15	12	8000 + Screen Taps	P.P. 15 3.75*
		Ultra-Linear Oriented Grain Steel For 6BQ5's (EL84's)	
OP387/15	12	8000 + Screen Taps	P.P. 15 3.75*

*Also available in 8.4 and 2.1 ohms.

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Type No.	Primary Volts	H.T. Volts	H.T. mA	Low-Tension Secondaries
PF619	240	150/150	30	6.3V—1.8A
PF299	240	285/285	40	6.3V—2A 6.3V—tap5V—2A
PF201	240	225/225	50	6.3V—2A
PF151	230, 240	285/285	60	6.3V—2A C.T 6.3V—tap 5V—2A
PF1460	230, 240, 250	250/250	80	6.3V—2A C.T 6.3V—2A 6.3V—tap5V—2A
PF130	230, 240	285/285	100	6.3V—2A C.T 6.3V—2A 6.3V—tap5V—2A
PF174	230, 240	285/285	150	6.3V—3A 6.3V—3A C.T. 6.3V—tap5V—3A

POWER TRANSFORMER
General Purpose—Voltage Doubling

Type No.	Primary Volts	H. T. Volts (R.M.S.)	DC Output After Doubler Volts	DC Output After Doubler mA	Low Tension Secondaries
PVD100	250 240 230	120 110 100	310 285 260	80	6.3V—3A CT
PVD102*	250 240 230	120 110 100	310 285 260	100	6.3V—4A CT
PVD103	250 240 230	50 140 130	380 355 330	100	6.3V—5A CT
PVD104	250 240 230	120 110 100	310 285 260	125	6.3V—3A CT 6.3V—3A
PVD105	250 240 230	146 136 126	380 355 330	125	6.3V—3A CT 6.3V—3A
PVD108	250 240 230	173 163 153	450 425 400	150	6.3V—3A CT 6.3V—3A
PVD109	250 240 230	146 136 126	380 355 330	180	6.3V—3A CT 6.3V—4A
PVD110	250 240 230	193 183 173	500 475 450	200	6.3V—3A CT 6.3V—4A
PVD111*	250 240 230	124 114 104	310 285 260	150	6.3V—3A CT 6.3V—3A CT

*Also available in flat mounting;

LOW VOLTAGE EQUIPMENT TRANSFORMER

Type No.	Primary Volts	Secondary Rating
PF537	240	17V tapped 11.5V—0.4A
PF1848	240	17V—1.25A
PF265	240	17V tapped at 11.5V, 10V, 8.5V at 4.2A
PF2344	240	18V, 0, 18V, 2.5A
PF2114	24	20V, 0, 20V, —2A DC
PF2440	240	19.4V, 0, 19.4V, —1.5A DC
PF2228	240	30V—0.6A
PF1763	240	30V tapped at 25V, 20V—2A
PF2876	240	32V at 1A 32V at 1A
PF2004	240	35V, 0 35V, —750mA
PF114	240	50V—2.3A tapped at 24V—4.8A tapped 12V—9.6A
PF115	240	50V tapped at 30V, 25V, 15V—5A
PF2235	240	150V, 125V, 100V, 75V, 50V, 25V, or 75V 0 75V at 30mA 6.3—1.2A

FILAMENT TRANSFORMERS

Tpye No.	Prim.	Secondary Rating
PF1290	240	6.3V—0.6A insulated for 2500V working
PF2315	240	6.3V—1.2A
PF1728	240	6.3V—1.1A, 6.3V—1.1A or 12.6V—1.1A C.T. if series connected or 6.3V—2.2A parallel windings.
PF1630	240	5.3V—2.25A C.T.
PF476	240	6.3V—3A C.T.
PF162	240	6.3V—3A, 6.3V—3A C.T. or 12.6A—3A C.T. if series connected.
PF2565	240	12.6V—0.5A 12.6V—0.5A or 25V—0.5A if series connected or 12.6V—1A parallel windings.
PF2851	240	12.6V C.T. at 0.15A.

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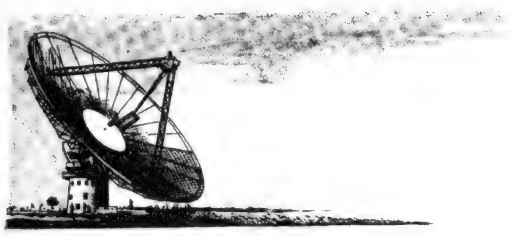

Computers for Vic. colleges

International Computers Ltd. is to participate in what is possibly the largest scale of development in computer education to be undertaken in technical institutes in Australia. Colleges affiliated with the Victorian Institute of Colleges have ordered six 1900-Series computers worth more than $1,800,000. The cost of the installations will be met equally by the Commonwealth and State Governments.

The computers will be used mainly for teaching computer techniques, but will also be used for some research and for college administration. Already, some 6,000 students at the Victorian Technical Institutes receive computer training, using existing computer facilities. This number is expected to increase to about 14,000 by 1972. The programming languages to be taught include COBOL, FORTRAN, and ALGOL.

Colleges which will have ICL 1901As with a card reader, line printer and twin exchangeble disc store are the Ballarat School of Mines and Industries; Footscray Institute of Technology; Gordon Institute of Technology, Geelong; Preston Institute of Technology; Swinburne Institute of Technology. The Caulfield Institute of Technology has ordered an ICL 1903A for 1969, but this will be replaced by an ICL 1904A in 1970.

The 1903A at Caulfield Institute will have a real time clock, a fast (1,600 cards a minute) reader, paper tape input and output, a 1,350 line per minute printer, four magnetic tape units, two exchangeable disc stores and four remote teletypes. The teletypes may be placed in different departments of the Caulfield campus or in other colleges. All will be used by students to gain experience in time-sharing and multi-access techniques.

The Victoria Line

A visitor to a London exhibition tries one of the new electronic gates that operate throughout the Victoria Line, the new section of London's underground which opened recently. The automatic gates, operated by magnetically-encoded tickets, control passenger entry and exit at all stations. When completed, the 14-mile long "tube" with its 16 stations under the heart of London will have a peak capacity of some 25,000 passengers an hour in either direction.

Human factors in telecommunications

Among the tasks to be allotted to a new computer system to be established at the Dollis Hill research station of the British Post Office will be the study of human factors in telecommunications. The on-line process control equipment, embodying an Elliot 900 series system, will be installed within the next few months at Dollis Hill, and among its first jobs will be experiments to determine the best design for a push-button telephone. Using human volunteers, researchers will study such factors as the layout of the keys and their "feel" (how soft should the spring be, how much movement when pressed?). Knowledge gained about the duration of each keying contact and the time lapse between them is expected to assist engineers designing future electronic exchanges.

Another experiment—part of an extensive program of research to be undertaken—is to determine whether it would be worthwhile having a display unit to tell a subscriber calling a long number what digits he has already dialled.

Human factor research at Dollis Hill has already resulted in a change in the design of telephone handsets in public call boxes — making the dial two inches lower and tilted at a shallower angle.

Laser aids tunnel work

The Tasmanian Hydro Electricity Commission is using laser beams to align tunnels and expects to save more than $4,000 a year as a result. The Commission's deputy supervising surveyor gave details of the scheme in a technical paper delivered at a recent Survey Congress. He said that normal alignment costs averaged more than $6,000 a year for the 14,000ft Wilmot diversion tunnel of the Mersey-Forth development, and laser methods had been tried as an experiment to test efficiency and cost saving of such a system. He said that in good conditions the laser could be used for distances up to 4,000ft and had required shifting only three times during the construction of the Wilmot tunnel. Commission engineers designed a special mounting to allow final adjustment and to withstand shocks from blasting.

The Commission now plans to use the laser for alignment control of a mole tunnel in the Fisher project, part of the Mersey-Forth development. This tunnel is only 8ft in diameter and the mole requires constant control to ensure accurate alignment. However, the small diameter makes normal surveys difficult. With the laser method of control developed by the H.E.C. engineers, the mole driver controls the alignment by watching a grid pattern of lights in the driving cabin.

Another way in which the Commission has used a laser beam was in the construction of the Pindari Dam. The beam was aimed across the sloping face of the dam wall to gauge the placing of loads on the wall face. Using the laser beam as a plane of reflex, operators working on the dam walls were able to place the fine rock of the upstream wall with high accuracy, thus saving time in after-trimming of the wall face, and allowing considerable economies in concrete.

Military television camera

This television camera, with a telescope sight and stock like a rifle, is now undergoing trials for battle-field observation from helicopters with the British Army. Developed by The Marconi Company Ltd., Chelmsford, Essex, England, the camera, which is fitted with a powerful zoom lens, would be used to provide instantaneous pictures to a forward command post while a reconnaissance mission is being flown. Good quality pictures have been relayed several miles over a radio link to a ground station.

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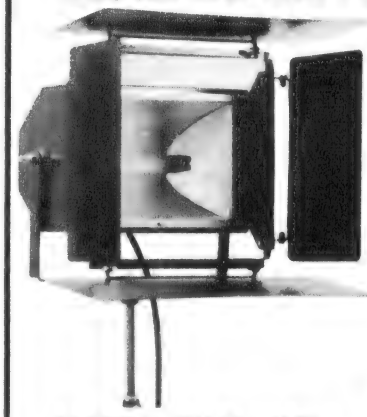

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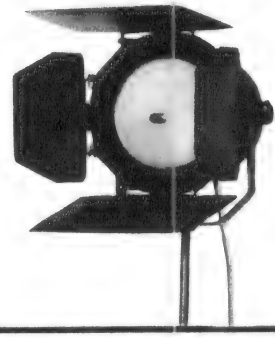

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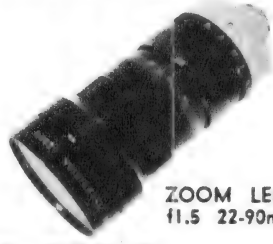

ZOOM LENS f1.5 22-90mm

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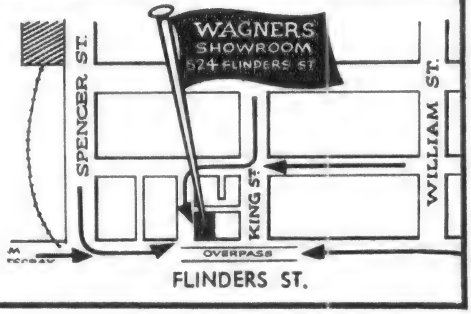
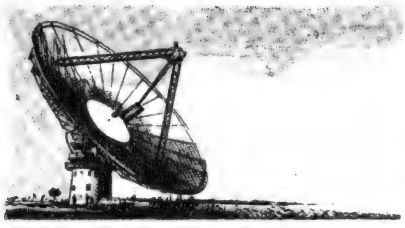




Electronic weighbridge

An electronic weighbridge system designed to find the centres of gravity of ISO freight containers in two planes is to be installed in a container berth at Liverpool Docks, in the U.K. To be supplied by W. and T. Avery Ltd., of Birmingham, the 76-ton capacity system consists of a weighing platform supported on load cells, connected through a static digitiser to a digital indicator and automatic weigh printer. The installation will comply with British Board of Trade accuracies, and will record the lateral and longitudinal centre of gravity positions within plus or minus three inches.

Military space terminals

The Marconi Company Ltd. has been awarded a military space terminal contract worth over $2 million by the British Ministry of Technology. It involves the supply and installation of a complete fixed satellite communications terminal in southern England and the modification of two existing stations overseas. All three will operate in the "Skynet" system designed to provide the British Services with reliable long-distance radio communications using synchronous satellites. The existing overseas stations, in the Middle and Far East, were partially experimental and are to be modernised for continuous operation with "Skynet" satellites.

Plankton as food?

The possibility that plankton could provide Man with a cheap and plentiful source of food supply is currently being actively studied, with the result that scientists are taking a considerable interest in the behaviour and environment of these minute marine creatures. At the Scottish Marine Biological Association's research station at Millport, in the Firth of Clyde, a comprehensive study is being made of the light-emitting characteristics of plankton. This facility is possessed by many underwater creatures, even those existing at great depths, where the penetration of natural daylight is virtually non-existent.

The Millport station is paying particular attention to a species of minute plankton called Dinoflagellates. These plankton emit light in short pulses, particularly when disturbed or attacked. The biologists at the station required a means of measuring and recording the very weak flashes of light emitted by the Dinoflagellates, and for this purpose the Plessey Electronics Research Laboratory at West Leigh, Hampshire, England, has developed a special photometer sensitive enough to measure the minute amount of light produced by the Dinoflagellates. Basically, the equipment consists of a photomultiplier light detector encased in a pressure-tight housing capable of withstanding water pressures at depths in excess of 1000ft. This is connected by cable to the research vessel where signals are fed to a pen recorder operating in conjunction with temperature and depth gauges.

Seawater battery

A salt-water battery capable of operating 20,000ft beneath the ocean surface for as long as five years has been patented by a Lockheed-Electronics Company engineer. The inventor, Charles L. Opitz, described his creation as "essentially a waste-paper basket with steel wool in it." The battery works on the principle that dissimilar metals, in the presence of an electrolyte, will produce an electric current. The Opitz battery uses a magnesium billet surrounded by steel wool and enclosed in a sheet metal cage. Sea water serves as the electrolyte. The battery can produce up to one watt of electricity, enough to power underwater beacons or acoustic devices. It is expected to cost about $US150.

More PABX for Fiji

The Posts and Telegraphs Department in Suva, Fiji, has ordered the latest type of Pentacosta Private Exchange to be installed at Nandi Airport for the use of Qantas. Standard Telephone and Cables Pty. Ltd., of Sydney, will provide the equipment, the fourth unit of this type to be supplied for Fiji since 1963. This latest order is for a 150-line system. Apart from handling normal telephone traffic, the new system makes provision for the increasing volume of traffic expected to be handled by the Qantas booking centre.

Uni. computer system

The Institute of Sound and Vibration Research, at Southampton, U.K., is one of Europe's first university establishments to be equipped with computer facilities to analyse information "on-line" while experiments are being conducted. The computer is a Marconi "Myriad II" which has already been operating for over a year during the final stages of contruction of the Institute building. Nearly every laboratory in the building is wired to the computer for instantaneous analyses of experiments. Alternatively, the computer can perform analyses later, from tape recordings.

Most of the research work carried out at the Institute is concerned with the detection and analysis of sound and vibration arising from many types of machinery. Investigation of sonic problems concerned with supersonic aircraft have been analysed by the Southampton computer. ◻

Thirteen members of the House of Assembly for Papua and New Guinea recently inspected the A.W.A. engineering products works at North Ryde, near Sydney. The party, including Mr W. H. D. Dutton, M.H.A. (right) formerly of Sydney, was welcomed by assistant manager Ron Stewart.

A Simple, Low-cost Transistor Power Supply

Here's a small variable power supply for the many jobs which don't really need the performance of a costly regulated unit. Simple and inexpensive, but at the same time burnout-proof, it should be ideal for servicemen, students, amateurs and experimenters.

by Jamieson Rowe

There are many occasions in electronics when the job at hand calls for one or more sources of adjustable low-voltage DC. Such occasions arise frequently in circuit development and equipment servicing, in teaching institutions and in amateur experimental work.

It is, of course, possible in such situations to derive the required voltages and currents from fully regulated supplies, of the type which we have described in April, 1966, and September, 1968. However, supplies of this type tend to be rather too expensive to permit the convenient acquisition of even a moderate number. Furthermore, in many cases the high regulation and filtering performance provided by such supplies is not really required.

Accordingly, there are many potential applications for rather simpler and less costly types of power supply unit, capable of little more than the supply of an adjustable low voltage under modest loading conditions. A desirable but perhaps not essential feature of such supplies would be inbuilt overload protection, if this could be provided at low cost.

The small power supply described in this article has been designed expressly for this type of application. It is a simple, low cost unit based around easily obtainable components, and would be suitable not only for "one-off" construction and use by the individual serviceman or experimenter, but also for multiple construction and use by development labs and teaching institutions.

Despite its simplicity and economy, the unit offers a performance specification adequate for most not-so-critical jobs. Output voltage is adjustable from around 1.5V to above 20V; available load current at 1.5V is close to 1A, dropping to around 200mA at 20V. Output is not regulated, but effective supply resistance is low — from 1 to 5 ohms, approximately, depending upon load voltage and current. Output ripple and noise is less than 300mV peak-to-peak before current limiting. And, in addition to these features, we have been able to provide the unit with inbuilt protection against overload damage.

The circuit diagram of the new supply shows that it uses a minimum of components. At the heart of the design is a simple "active" voltage divider circuit, using a modern NPN silicon power transistor as the shunt element, and fed from a conventional bridge rectifier circuit using a small 15V/1A stepdown transformer and four 1A silicon rectifier diodes.

The transistor, a type 40250, is effectively connected as an "upside-down" emitter-follower across the rectifier output. The power resistor(s) in series with the negative line form its emitter load, while its base is connected to a potentiometer which is also wired across the rectifier output. The output terminals are connected across the transistor itself, positive to collect or and negative to emitter.

Because of the emitter-follower configuration, the transistor acts to duplicate approximately at its emitter the voltage level at its base. Hence when the base is carried by the potentiometer to the positive rectifier output, the voltage drop of the transistor—which is the output voltage—drops to near-zero. Conversely, if the base potentiometer is turned to the opposite extreme, the output voltage will tend to rise and approach the full rectifier output. Intermediate positions of the potentiometer will tend to give appropriate fractional output voltages.

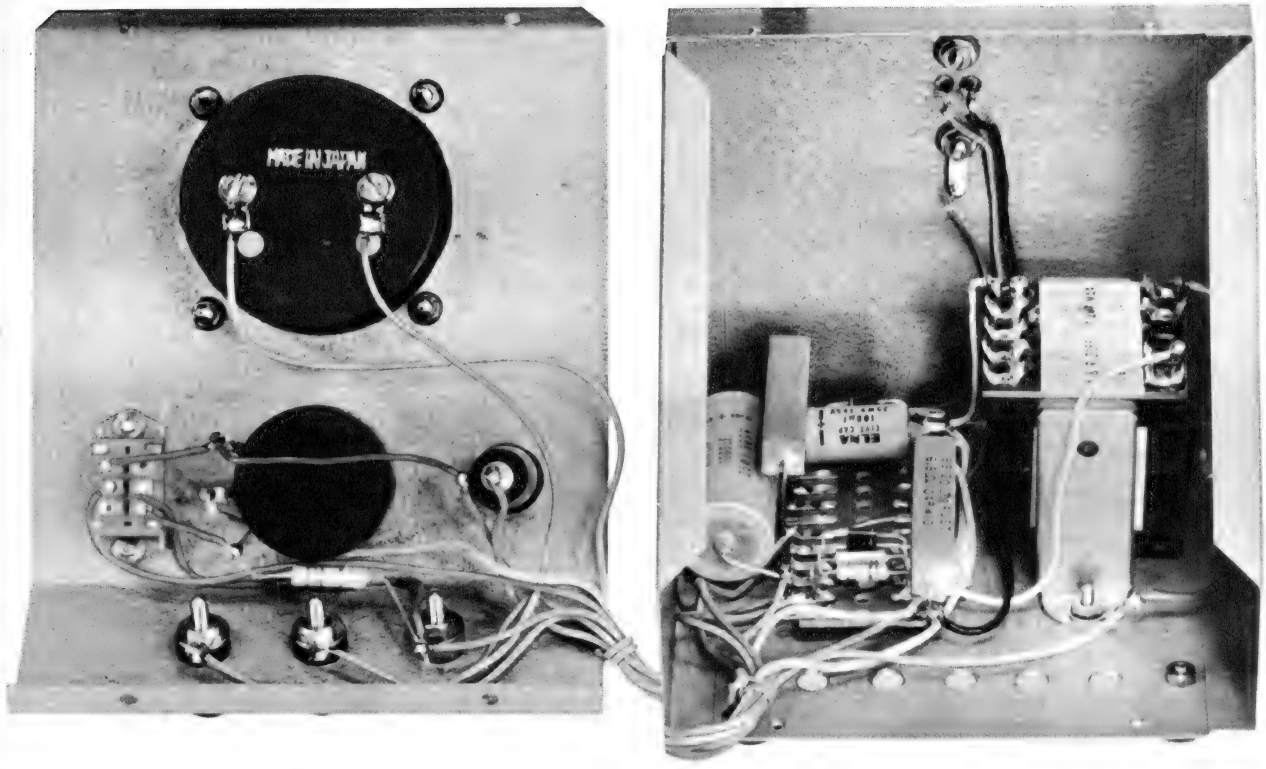
The use of a transistor as an emitter-follower is quite common in power supplies, and has the advantage of giving the supply an intrinsic output resistance considerably lower than would be obtained with a simple "passive" voltage divider system. However by using the transistor as the shunt divider element, in contrast with the more usual practice of using it as the series element, the present design gains simply and at virtually no additional cost an important advantage: inherent protection against output shortcircuits.

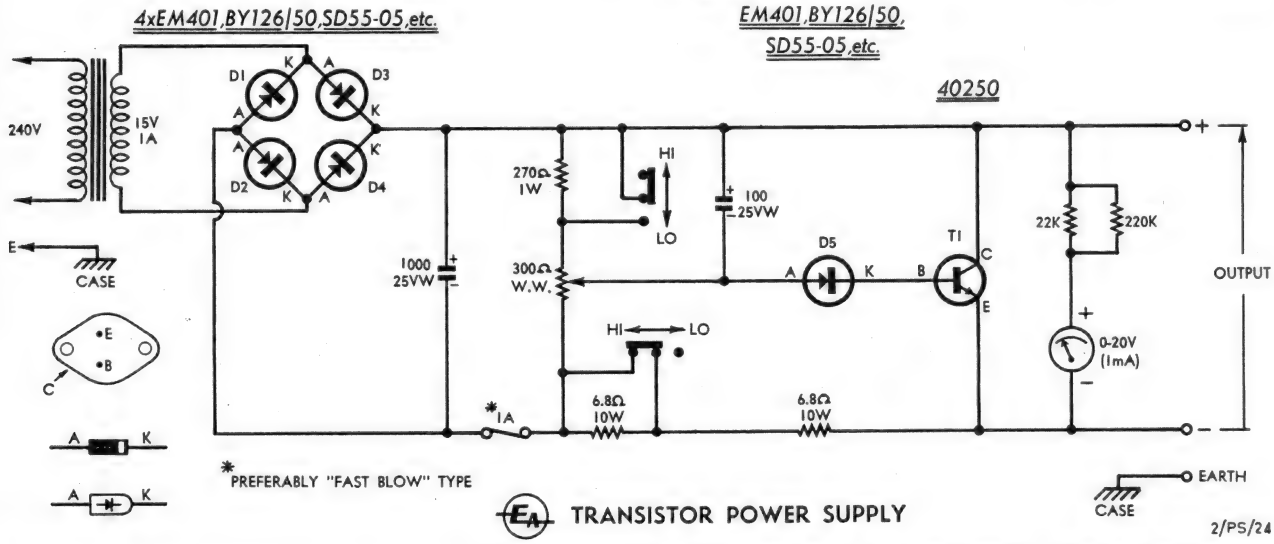
Because the output terminals are connected directly across the transistor, any load connected to the terminals is effectively connected in parallel with the transistor. The current drawn by a load therefore subtracts from that which must otherwise be drawn by the transistor in order to maintain a given output voltage, and thus the transistor dissipation actually falls with supply loading. If the output terminals are short-circuited, the transistor is simply cut off; the rectifier circuit is presented with the significant but not unduly embarassing load provided by the series divider resistors.

It should be appreciated that the foregoing state of affairs is somewhat in contrast with that of the more usual circuit, in which the transistor is connected as the series divider element. In such circuits the transistor dissipation rises with load current, and special precautions must be taken if the transistor is not to be ruined by the excessive current which tends to flow on short-circuit.

Although the transistor is thus protected by the basic circuit configuration against collector over-dissipation, it is also necessary that it be protected against base-emitter reverse bias breakdown in the event of a short-circuit applied when the base potentiometer

The prototype supply, built in a small sloping-front case. Simple, inexpensive and rugged, it is ideal for most experimental work.





At top is a view of the interior of the new supply, showing the few components involved and their placement. Below is the circuit, which may be used in conjunction with the wiring diagram overleaf.

is turned for near-maximum output. This is in fact the purpose of the diode in series with the base, which prevents base current flow in the reverse direction.

The value of the voltage divider series element necessary to prevent excessive "internal" supply dissipation in the minimum output condition is approximately 14 ohms, being here provided by two 6.8 ohm 10 watt power resistors. However, because this value tends to limit somewhat unduly the current available from the supply at higher voltages, provision has been made for halving this element in value when required by means of a slide switch which shorts out one resistor. At the same time the switch is arranged to insert a fixed resistor in series with the "low" end of the base potentiometer, ensuring that the "internal" dissipation of the supply is limited.

Externally the effect of the switch is to provide a second, "HI" range in which additional current is available, but only for a range of output voltages limited from about 11-20V.

As with the normal or "LO" range, an output short-circuit on the HI range merely causes the transistor to switch off. However, because the current load on the rectifier circuit in this case becomes excessive, a protective fuse has been provided. The fuse should be rated at either 1A or preferably 800mA if this value is available, and should ideally be of the "fast-blow" variety to prevent excessive overheating of the transformer and rectifier diodes.

An output voltmeter is provided, to permit convenient adjustment and monitoring of supply output during operation. The meter used in the prototype is an economy 3-inch rectangular type of Japanese manufacture, designated type VP-2A and having a standard 0-1mA/100 ohms characteristic. We removed the original 0-1 scale markings with a typewriter eraser and replaced them with an appropriate 0-20V numbering.

Neither side of the basic supply is internally connected to the case and mains earth, but rather a third "earth" output terminal is provided to permit either output polarity to be tied to earth if and when required. This approach offers complete flexibility, at no sacrifice in performance and at an additional cost of only a few cents.

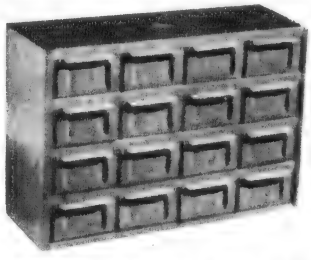
As may be seen from the photographs, the supply is constructed in a compact sloping-front case which makes it very suitable for convenient bench-top operation. The case is a standard type masuring 5in x 5in x 5in, and having a wrap-over front

CHEST OF DRAWERS

Three types of Galvanised Chests measuring 17⅛in x 6¾in x 11⅞in, containing 16 drawers, each measuring 6⅝ x 3¾in x 2⅛in.

- TYPE C.D.1. With 16 undivided drawers, **$7.00.**
- TYPE C.D.2. With 16 triple compartment drawers, **$8.00.**
- TYPE C.D.3. With 8 triple compartment drawers, and 8 undivided drawers, **$8.00.**

The Chests are finished in blue hammertone stoving enamel, are complete with identification cards and packed in strong corrugated cartons. Provision is made for all units to be bolted together in tiers.

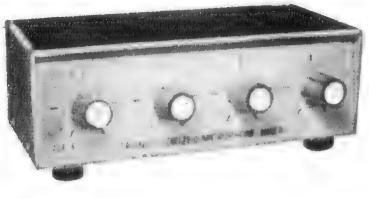


CHEST OF DRAWERS TYPE C.D.4.

A 17⅛in x 6¾in x 11⅞in Galvanised Chest containing 4 full-length drawers each measuring 15¾in x 6⅝in x 2½in. Finished in blue hammertone stoving enamel. **$7.00.**

WRITE FOR FREE CATALOGUE AND PRICE LIST OF TOOL BOXES AND CHEST OF DRAWERS.

MODEL M6 FOUR CHANNEL TRANSISTORISED MICROPHONE MIXER



All four inputs accept standard two circuit Phone Plugs, while the output jack accepts a standard circuit Phone Pin Plug.

SPECIFICATIONS:

● Input Impedance: "Hi" Impedance for Crystal Microphone, etc. ● Gain: Approximately 6 db. ● Maximum Input Signal: 1.5 volts. ● Maximum Output Signal: 2.5 volts. ● Output for Minimum Distortion: 2 volts. ● Hum: 0. ● Battery: 9 volts.

Mono $6.75 Stereo $9.75

BELLPHONE

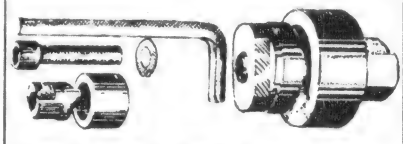
Pick up the receiver and dial push number desired.

Price $9.00 per pair

KALTRO SVC TV-RADIO REMOTE CONTROl LISTENER

This TV-Radio Remote Control Listener is a combination of an extension speaker and a remote control station to regulate the sound of both the TV, Radio, Phono, or Hi-Fi set and the speaker incorporated in the Listener itself. In addition, up to two earphones can be attached for listening to the sound of the TV, Radio, Phono, or Hi-Fi set without disturbing others around you. Unwanted commercials can be easily cut off by merely turning down the control of the TV-Radio Remote control Listener. A modern designed plastic cabinet with easily adjustable fingertip controls ideal for use in home, office and business. Complete with earphone, 20ft of lead wire and installation instructions.

Price $8.75



"PIPGRAS" HOLE PUNCHES

"PIPGRAS" Hole Punches are made from Alloy Tool Steel, and cut clean and accurate holes in sheet metal. They make a smooth, perfect hole without reaming or filing.

SCREW TYPE, ROUND

Supplied with "UNBRAKO" High Tensile Socket Screws and Wrenches. Cut holes in sheet metal up to 18 gauge.

Type No.	Nominal Size	Actual Size	Water Pipe Size	Pilot (I.D.)	Drill Size	Price Each
32.S	⅛in	0.507in	—		¼in	$2.17
40.S	3/16in	0.618in	¼in	5/16in		$2.17
48.S	¼in	0.742in	3/16in	5/16in		$2.80
56.S	5/16in	0.884in	½in		3/16in	$3.80
64.S	1in	1.008in	—		3/16in	$4.10
72.S	1⅛in	1.133in	¾in		3/16in	$4.53
76.S	1/3/16in	1.172in	—		3/16in	$4.53
80S	1¼in	1.258in	—		3/16in	$4.97
88.S	1⅜in	1.382in	1in	7/16in		$5.97

With Heat Treated, High Tensile Steel Hex. Head Bolt and Nut.

Cut holes in sheet metal up to 16 gauge.

96.S	1½in	1.512in	—	9/16in	$6.68
112.S	1¾in	1.762in	1¼in	9/16in	$7.60
128.S	2in	2.014in	1½in	9/16in	$8.33

THIS MONTH'S SPECIALS

PK.633 Transistorised Tuners, 9 volt	$10.25
PK.544 5 Transistor Miniature Push Pull Audio Amplifiers, 9 volt	$8.50
Palace MD200 Audio Amplifier Module Imp. 5000 Ohm. Output, 8-16 Ohm. 9 volt.	$5.50
Zephyr 26 x A Crystal Microphones	$0.75
Resistance Boxes.	$4.25
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Stylovue.	$1.50
Micro Stylus Scope.	$3.00

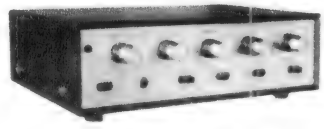
8 WATT STEREO AMPLIFIER MODEL SA-80S OPERATING MANUAL

SPECIFICATIONS

Output Power: 8 Watt, 4 Watts per channel.
Frequency Response: 60 to 15,000 cps. plus or minus 1 db.
Harmonic Distortion: Less than 3%.
Hum and Noise: 52 db below rated output.
Sensitivity: Phone (Crystal) 100mV 250K ohm.
Tuner 100mV.
Tube Complements: 12AX7x1, 30A5x2, 1S315x1 (Silicon Rectifier).
Dimensions: 5.1lb. 9¾in x 6¼in x 3in.

Price $35.00

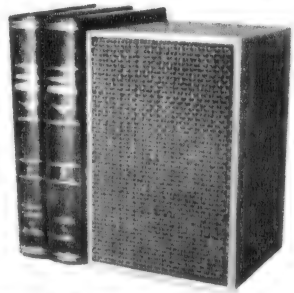
"PALACE" SOLID STATE STEREO AMPLIFIER Model AM-320



Power Output: 16W (8W per channel).
Frequency Response: 80-10,000 cps plus or minus 1dB 1W; 50-20,000 cps plus or minus 2dB 1W.
Harmonic Distortion: Less than 2% at 3W; less than 4% at 5W; less than 4.5% at 8W.
Tone Control: Bass plus or minus 10dB at 50 cps. Treble plus or minus 10dB at 10,000 cps.
Loudness Control: Plus 6dB at 50 cps; plus 4dB at 10,000 cps.
Input: Tape head 3.5mV; Mag. 3.5mV; Cer. 100mV; Tun., Aux. 150mV.
S/N Ratio: Minus 45dB.
Transistor complement: 2SB347 x 2, 2SB345 x 8, 2SB481 x 4.
Power Supply: 117V AC 50/60 cps.
Dimensions: 10¾in (W) x 3½in (H) x 8⅛in (D).
AM-V320 Upright.

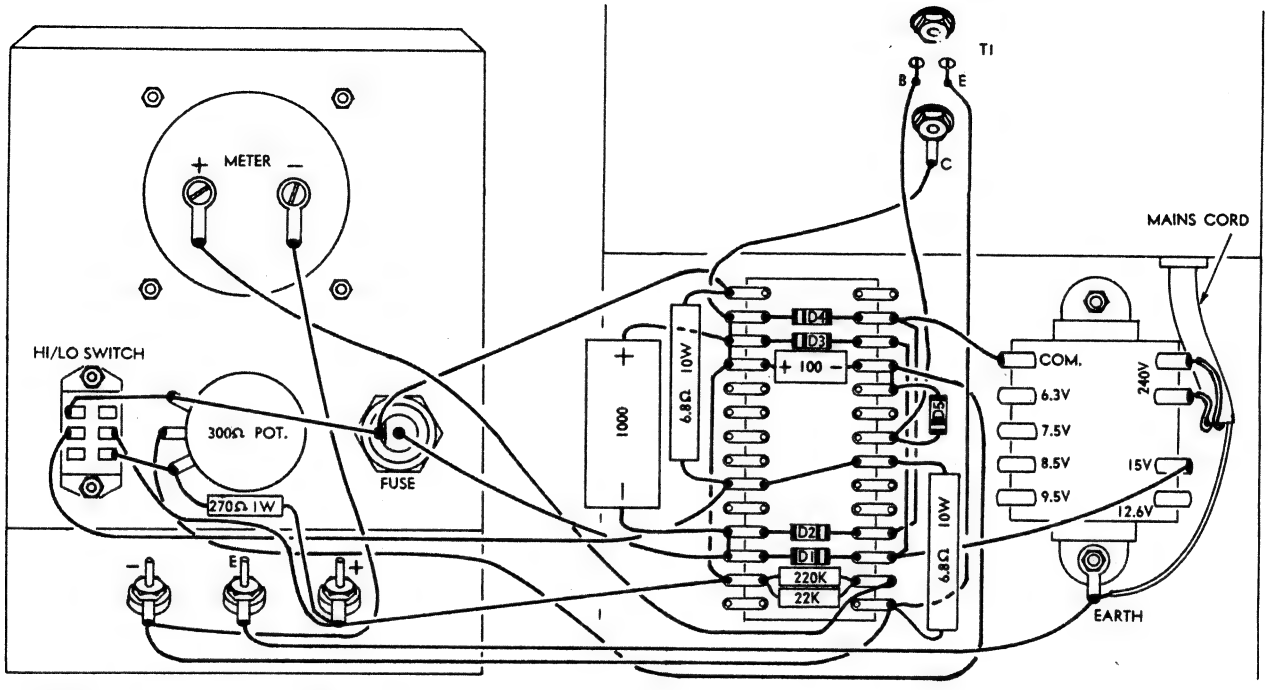
Price $92.00

BOOK SHELF TYPE SPEAKER SYSTEM MODEL SP-4S

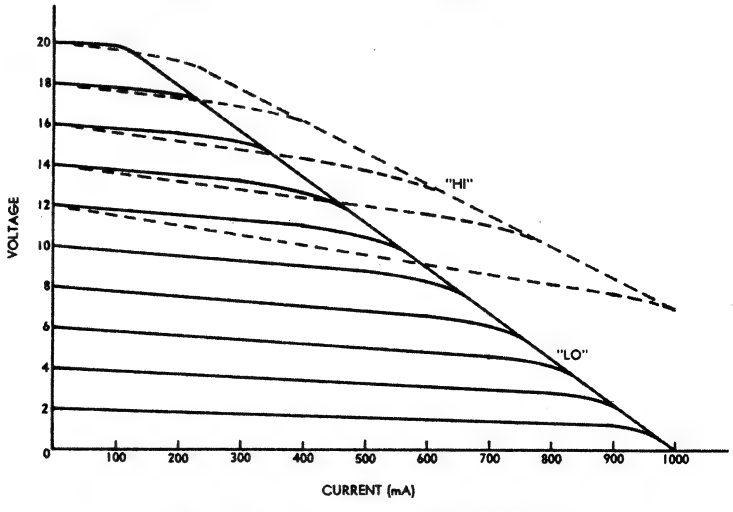


Speaker: 4in, 8 ohms.
Frequency Response: 70-13,000 cps.
Sensitivity: 93dB.
Power Input: 8W (Music Power).
Cabinet Size: 9⅞in (H) x 6¼in (W) x 5⅞ (D).
Finish: Walnut lacquer.

Price $12.50



Above is the complete wiring diagram of the new supply, while at right are curves showing the typical performance under loading.



panel (Heating Systems type SF-5 or similar).

The output voltmeter is mounted at the top of the sloping case panel, with the output potentiometer beneath it and the fuse and range switch mounted to the left and right of the latter, respectively. The three output terminals are mounted at the lower front of the case, with the earth terminal in the centre to allow convenient linking of either output terminal when required.

The power transistor is mounted on the outside of the upper rear of the case. Although the transistor body is connected internally to the collector and must therefore be isolated electrically from the earthed case, for efficient cooling of the device the two must be closely coupled thermally so that the case can act as a heatsink. To achieve this the lacquer finish of the case is removed from the area immediately beneath the transistor, and the mica insulating washer supplied with the device is coated with the usual silicone grease.

Although the case of the supply is quite small, the interior is not unduly crowded as a result of the few components used. The power transformer occupies the lower right-hand area, with most of the minor components supported alongside by a 14-tag length of miniature resistor panel.

The position of all components is shown in the wiring diagram and the photographs, and constructors should as a result have little difficulty in duplicating the unit if they so desire. However the wiring is not critical, and providing care is taken to provide the components with suitable mounting support and adequate ventilation, all should be well.

In the interests of safety the mains cord is clamped to the bottom of the case immediately upon entry via a grommeted hole at the rear, the clamp being between the transformer and the right-hand side of the case. The transformer is mounted with the primary winding lugs nearest to the cord entry, so that the mains wiring is kept as far as possible from the low-voltage circuitry. The mains earth connects to the case via a solder lug under one of the transformer mounting screws, and thence to the front panel terminal.

When the supply is completed and put into operation, it will be found that the transistor body and the adjacent case surface become quite warm, even hot if the unit is set at the "minimum" position of the "HI" range with no external load connected (the latter condition is that corresponding to maximum transistor dissipation). Do not be alarmed at this, as it is quite normal and has been allowed for in the design of the unit. ■

List of Components

1 Sloping front case, 5in x 5in x 5in.
1 Stepdown transformer, 15V—1A.
5 Silicon diodes, type EM401, BY126-50, or similar.
1 Transistor, type 40250, or similar, with mica insulating washer.
1 3in rectangular meter, 0-1mA/100 ohms.
2 6.8 ohms 10 watt resistors.
1 270 ohms 1 watt resistor.
1 300 ohms wire-wound pot.
1 22K ½ watt resistor.
1 220K ½ watt resistor.
1 1,000uF 25VW electrolytic.
1 100uF 25VW electrolytic capacitor.
1 DPDT slider switch.
1 1A or 800mA cartridge fuse and holder.
1 Mains cord and plug. Also grommet and clamp.
3 Screw terminals — red, green, black.
1 14-lug section of miniature resistor panel.
Nuts, bolts, washers, connecting wire, solder, handle and rubber feet for case.

By
Leo
Simpson

The photo at left shows one method of playing the keyless organ, with the fingers of the left hand manipulating the controls at the end of the case. This means that vibrato, volume and tone can be varied at will, without momentary breaks in playing. The full circuit diagram is on the facing page.

Topical novelty instrument—

A KEYLESS ORGAN

You can build this "Keyless Organ" as a toy, as a gimmick or as a novelty instrument for use by a group. Played by touching a stylus probe on to a series of gold contacts, it has a range of more than 1½ octaves, including sharps and flats, built-in vibrato, a pleasant woodwind sound and a surprising level of acoustic output.

The prototype instrument is housed in a metal case measuring 8¾ x 4½ x 2 inches but the external details can be varied to suit the need — and according to the ingenuity — of the individual constructor. It can be rested on a table-top or held in the hand and is completely self-contained, though its output could readily be fed into a high-powered amplifier system.

Interestingly enough, we considered presenting an instrument along these lines more than 12 months ago but the idea of using a stylus probe to play the required notes seemed to be altogether too primitive. However, we reckoned without Rolf Harris and his fascination for a commercial counterpart, as evidenced in a couple of his B.B.C. TV shows. This produced an immediate crop of requests from readers to describe a stylus version of the two monophonic instruments described in December 1967 and January 1968.

In fact, this is in no sense just another version of the earlier instruments. It represents an extension of the ideas behind those designs and, in terms of circuitry, is quite different.

Apart from its novelty, the stylus approach has the practical advantage of simplicity from the constructor's point of view. There is no need to contrive a keyboard, with its properly proportioned keys, pivotting, spring return, contacts, etc.; the player merely touches the tip of a stylus on to a metallic pattern which is part of a printed board — the pattern being shaped to resemble the layout of a keyboard, and hard gold plated to ensure reliability of contact.

People with a musical background can usually manage to play simple tunes straight off and, with a little practice, can manage staccato and glide effects by suitable manipulation of the stylus probe.

Like the earlier instruments, this one is "monophonic" a term which, in this context, means that it is capable of producing only one note at a time. If the probe bridges two contacts (or if two keys in the other instruments are depressed simultaneously) only the highest note will sound.

CIRCUIT DESCRIPTION: The monophonic characteristic of an instrument such as this stems from the use of a single tone generator for the whole range of notes. The notes are provided by manipulating the time constant of the tone generator.

In this latest instrument, the single tone generator is a relaxation oscillator featuring a new three-terminal PNPN device from the General Electric Company which is called a "programmable unijunction transistor" (PUT) with the type number D13T1. The theory of its operation was discussed in the "Know Your Semiconductors" article in the December 1968 issue. The three terminals of the PUT are designated as Anode, Anode Gate, and Cathode. For the purpose of this article it will suffice to know that the PUT is a device which can be arranged to function as a relaxation oscillator, as one of its many possible applications.

The time constant of the oscillator is determined mainly by the 0.0033uF capacitor and the series string of 21 resistors. Each note is selected by "tapping" the resistor string with a probe which is connected to the positive supply. The lowest note is selected by connecting the probe to the end of the resistor string so the total resistance is in circuit; higher notes use less than the total resistance in the string. A sawtooth waveform is generated at the anode of the PUT. A train of pulses at the same repetition rate with positive polarity appears at the cathode, while a similar train of pulses with negative polarity appears at the Anode Gate.

In a device such as this, it is desirable that the oscillator tolerate a falling battery voltage, as in a portable radio, to ensure that the battery voltage, has a long effective service life. In practice, the PUT oscillator will function at less than half the nine-volt supply with a frequency change of only a few per cent.

The range of the oscillator is from A-440Hz to F-1397Hz which is one octave above the range required — from A-220Hz to F-698Hz. There are two good reasons for operating the oscillator in this fashion.

In the first place, a rough sawtooth

waveform is not pleasant to listen to and requires extensive filtering before it is fed to an amplifier system. For this reason we have followed the oscillator with two NPN silicon transistors in a gated R-S flip-flop configuration to provide frequency halving and a square-wave output. The flip-flop is triggered from the Gate of the PUT. It may be thought that the flip-flop would "load" the oscillator but, in practice we found loading effects to be very slight.

We tried an integrated circuit flip-flop and, while it worked well, the current drain of around 25 milliamps was obviously too high for an application such as this. This is a frequent objection where IC's are considered, the high current drain offsetting their initial economy.

A further advantage of operating the oscillator over a high frequency range is that a smaller timing capacitor can be used. Since the PUT has low internal leakage, high values of resistance and a small timing capacitor can be used. This is not possible with conventional Unijunctions if reliable operation and high energy trigger pulses are required.

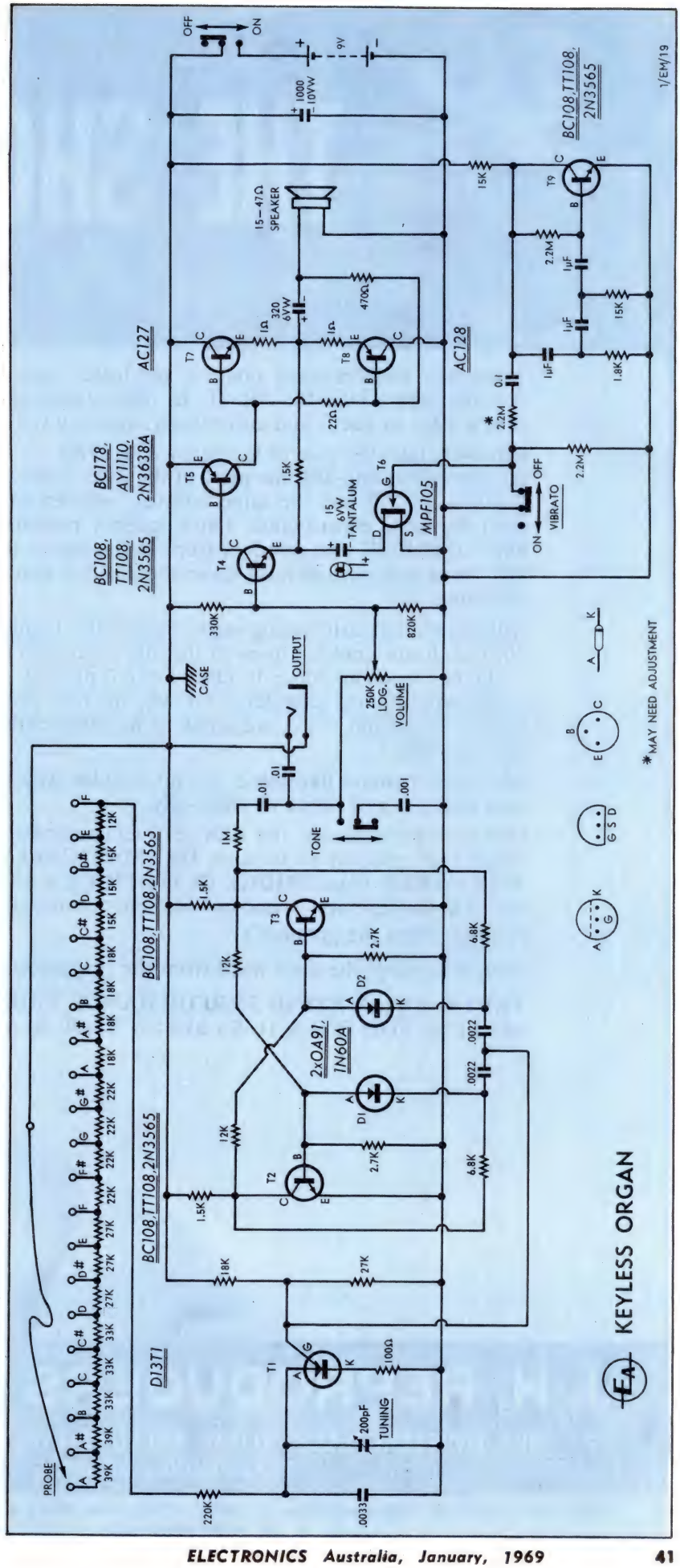
The use of a small capacitor makes it possible to incorporate a facility not previously available on simple instruments of this type — that of variable tuning. To tune an instrument of this type so that it can be played in conjunction with other instruments requires an adjustment to the timing capacitor. Merely having a potentiometer in the resistor string will not achieve this, since all notes must be changed by the same ratio.

In this PUT oscillator an additional 200pF or so will shift all the notes down in frequency by a semitone. We used a "solid dielectric" tuning capacitor, as used in small portable transistor radios, to achieve a tuning range of a little over a semitone. This will enable the instrument to be played in conjunction with pianos, which although usually right on standard pitch can be low by as much as a semitone.

It may be thought that a better way to obtain a square-wave output would be to use a conventional multivibrator directly, with one of the cross-coupling resistors in the form of a tapped resistor string to vary the frequency. The disadvantage of this approach is that the "mark-space" ratio of the rectangular waveform tends to vary with frequency.

At low frequencies, one might obtain a very close approximation to a square wave, with unity mark-space ratio, but as the frequency rises the waveform becomes more "spiky," the tonal quality changing markedly as the player moves up the scale. The system we have used, with a relaxation oscillator followed by the flip-flop, provides a waveform with a constant, unitv mark-space ratio regardless of the frequency.

The square wave output from the flip-flop gives a pleasant "woody" tone which, can be "softened" if desired by a simple top-cut filter. In the prototype instrument, we used a slide switch to provide a choice of two different tones. One position of the slide switch leaves the square wave unmodified while the other position connects a .001uF capacitor across the signal line



THE SHOW-OFF

There is a great reserved pride in the higher priced cartridges, such as the top-rated ADC.10E/Mk II. In quality and sound reproduction it is in a class by itself, and accordingly, you pay well for this prize.

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to give a slight "rounding off" of the square wave and a "mellow" tone.

The output from the flip-flop is fed, via the tone switch and volume control, to a four-transistor, complementary-symmetry amplifier. The class-B output stage has low curent drain at no signal and a maximum power output of over 400 milliwatts into a 15-ohm speaker with a nine-volt battery. The sensitivity of the amplifier is approximately 300mV for full output, depending on components in the feedback loop, with a minimum input impedance of 200K. We used a particular 15ohm loudspeaker but any loudspeaker with an impedance from 15 to about 47 ohms could be pressed into service. With a voice coil impedance greater than 15 ohms, power output will be reduced but so also will be the peak curent drain on the battery.

The 1000uF electrolytic capacitor connected across the battery serves to limit the rise in supply impedance as the battery nears the end of its service lite, minimising distortion and sustaining power output.

The "square wave" signal level from the flip-flop has been adjusted so that it will just drive the amplifier into clipping at the maximum setting of the volume control. This is to give a smoother volume control action and to avoid the tonal change and the undue demands on the battery which would follow if the output stage were grossly overdriven. The current drain at full "undistorted" output (i.e. just at onset of clipping) is of the order of 90 milliamps with a 15-ohm speaker. The output transistors are fitted with flag heatsinks to improve heat dissipation. With normal use they will run barely warm to the touch.

The output transistors are slightly forward biased by the 22 and 470-ohm resistors to provide a quiescent current of about 1 milliamp, which is enough to ensure freedom from cross-over distortion. The low value of quiescent current means that the usual temperature stabilisation thermistor can be dispensed with. The amplifier has very low distortion due to the large amount of negative feedback used.

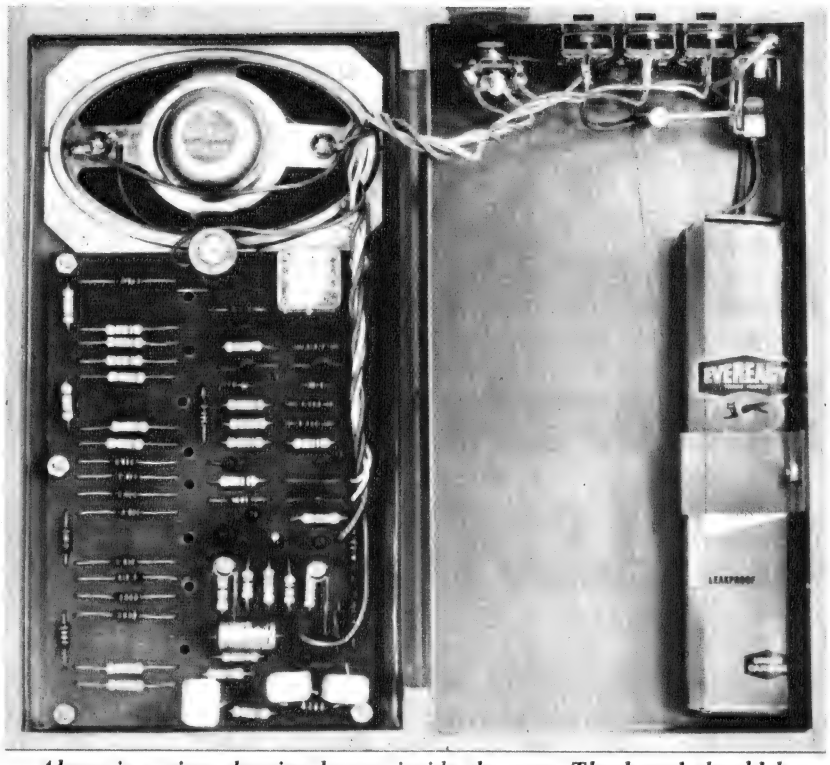
The signal from the flip-flop is also fed, via the tone switch and .01uF capacitor to an output socket for connection to an external amplifier. The level of signal available is of the order of 300mV (RMS).

The other major feature of the circuit is the vibrato, or more correctly, the tremolo or tremulant facility. Vibrato refers to a rhythmic variation in the frequency of a musical note at a rate of 5Hz to 10Hz. Tremolo refers to a variation in amplitude of a musical note at around the same rate. In a simple instrument it is hard to discern the difference between the two effects and the terms are often confused and interchanged. In our case "vibrato" (to mis-use the more common word) is achieved by modulating the negative feedback, and hence the gain, of the amplifier.

The circuitary is based on that published in the article on "Guitar preamp. and Vibrato" in the November 1968 issue of the magazine. It makes use of the fact that the drain-source resistance of a field-effect transistor can be modulated by a bias voltage applied to its gate electrode. We have specified either of two FETs, in order of preference. The first is a Motorola n-channel device, MPF105, while the second is the Fairchild economy p-channel device, 2N4360. The drain source resistance of these FETs is of the order of a few hundred ohms, which makes it admirably suited for use in the feedback loop of the amplifier. It is connected in series with the feedback loop via a 15uF/6VW tantulum electrolytic capacitor. The modulating voltage applied to the gate of the FET is a low-frequency sine wave obtained from a one transistor phase-shift oscillator.

While either FET type is suitable, the larger parameter spreads of the 2N-4360 could make satisfactory operation somewhat harder to attain.

The sine wave signal at the collector of the transistor, which has an amplitude of about 2V peak-to-peak, is applied to the gate of the FET via a blocking capacitor and a voltage divid-



Above is a view showing layout inside the case. The board should be mounted on the lid so that there is sufficient clearance between board and case. The leads from the lid to the components in the case should be long enough to allow the lid to be folded out, as shown.

PARTS LIST

1 case and lid. Inside dimensions 8¾in x 4½in x 2in.
1 4in x 2in elliptical speaker, 15-ohm (MSP type 4-2LB/15 or equivalent).
1 piece of expanded metal mesh, approximately 4in x 2½in.
1 battery (Eveready 2364 or similar) and plug to suit.
1 battery clamp.
3 slide switches.
1 printed board, 69/01.
1 250K(log) potentiometer.
1 knob to suit.
1 meter probe, with rounded point.
1 jack socket.
1 solid dielectric tuning capacitor (Elcom PVC-P22 or similar).

SEMICONDUCTORS

4 BC108, 2N3565 or similar silicon NPN type.
1 D13T1 programmable unijunction transistor.
1 MPF105 or 2N4360 FET.
1 BC178, AY1110, 2N3638A or similar silicon PNP type.
1 AC127/128 germanium complementary matched pair (with flag heat sinks).
2 0A91, 1N60A low power diodes.

RESISTORS

(½ or ¼ watt, 5 per cent tolerance)
4 x 2.2M, 1 x 1M, 1 x 820K, 1 x 330K, 1 x 220K, 2 x 39K, 3 x 33K, 4 x 27K, 4 x 22K, 5 x 18K, 5 x 15K, 3 x 12K, 2 x 6.8K, 2 x 2.7K, 1 x 1.8K, 1 x 1.5K, 1 x 470 ohm, 1 x 100 ohm, 1 x 22 ohm, 2 x 1 ohm (½ watt)

CAPACITORS

1 x 1000uF/10VW electrolytic
1 x 320uF/6VW electrolytic
1 x 15uf/6VW tantulum electrolytic
3 x 1uF metallised polyester
1 x 0.1uF polyester (not ceramic)
3 x .01uF polyester or ceramic
1 x .0033uF polyester
2 x .0022uF polyester
1 x .001uF polyester

SUNDRIES

1 grommet, hook-up wire, solder, spaghetti, screws, nuts, etc.

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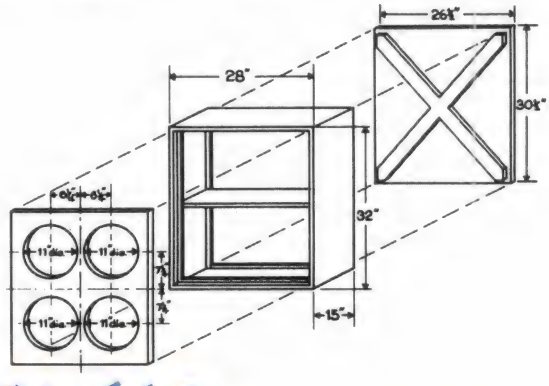
SPECIFICATION

TYPE NUMBER	50226/12PQ/15 PRESTIGE FINISH	21622/12PQ/15 MANUFACTURERS TYPE	53416/12PQ/8 MANUFACTURERS TYPE
Impedance	15 ohms	15 ohms	8 ohms
Frequency Range	35-6000 Hzs	35-6000 Hzs	35-6000 Hzs
Resonance	40 Hz	40 Hz	40 Hz
Maximum Power Handling	15 W	15 W	15 W
Magnet Material	Alnico V	Alnico V	Alnico V
Flux Density	10500 gauss	10500 gauss	10500 gauss
Total Flux	82000 lines	82000 lines	82000 lines
V.C. Diameter	1¾″	1¾″	1¾″
Mounting Hole Centres	11¾″ P.C.D.	11¾″ P.C.D.	11¾″ P.C.D.
Maximum Depth	6¾″	6¼″	6¼″



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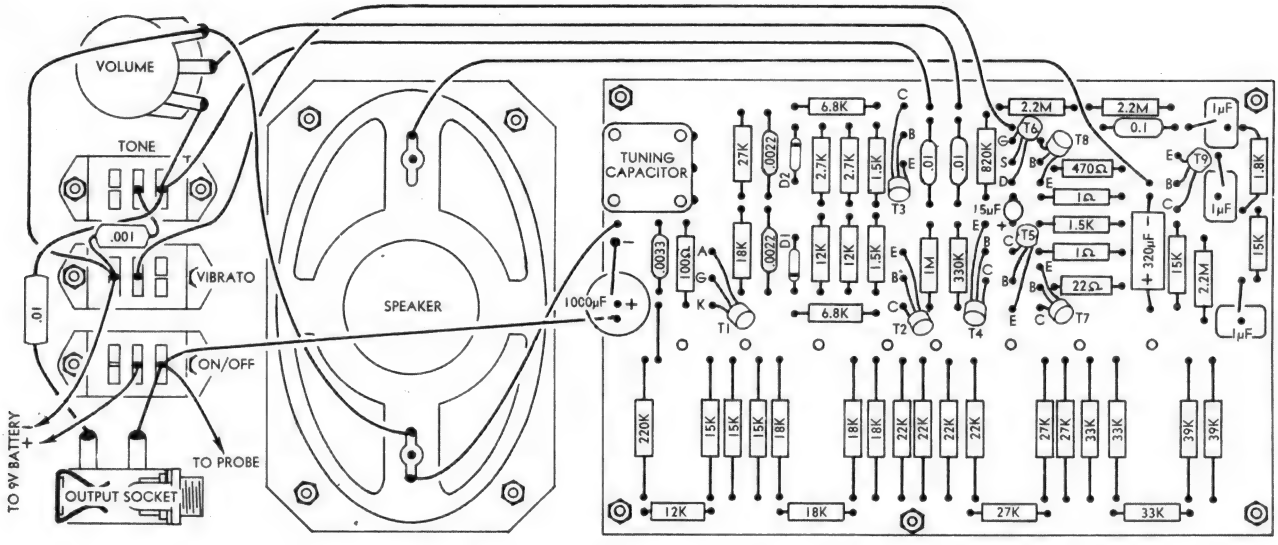
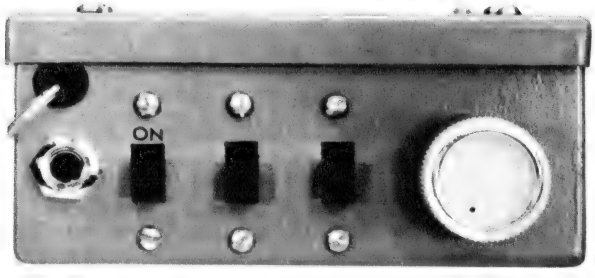


The above wiring diagram shows all the necessary details so that construction will be straightforward. Note that the case is connected to the positive supply rail.



At left is a view showing details at the end of the case. The socket allows the output from the flip-flop to be connected to an external amplifier. The other controls are, from left to right: On-off switch, vibrato switch, tone switch, volume control.

er network. The maximum modulating voltage applied to the FET gate should be less than the "pinch-off" voltage, otherwise a series of "plops" will emanate from the loudspeaker at the same rate as the vibrato frequency. As the "pinch-off" voltage varies for each device the voltage divider may have to be varied to obtain sufficient depth of modulation without the above effect. The total resistance of the voltage divider should not be reduced below about 4 megohms, while the value of the first divider resistor should not be decreased below about 470K.

The vibrato facility is disabled by connecting the gate of the FET to the negative supply rail, so that the FET drain-source resistance is unmodulated. Some readers may think it desirable to disconnect the supply to the phase-shift oscillator instead, to reduce battery drain, but the oscillator requires a few seconds to start.

The 1uF capacitors used in the phase shift network are metallised polyester types with a tolerance of plus or minus 10 per cent. Ceramic or tantalum electrolytic capacitors are not suitable, even when matched for capacitance, since their power factor and leakage are too high for this application.

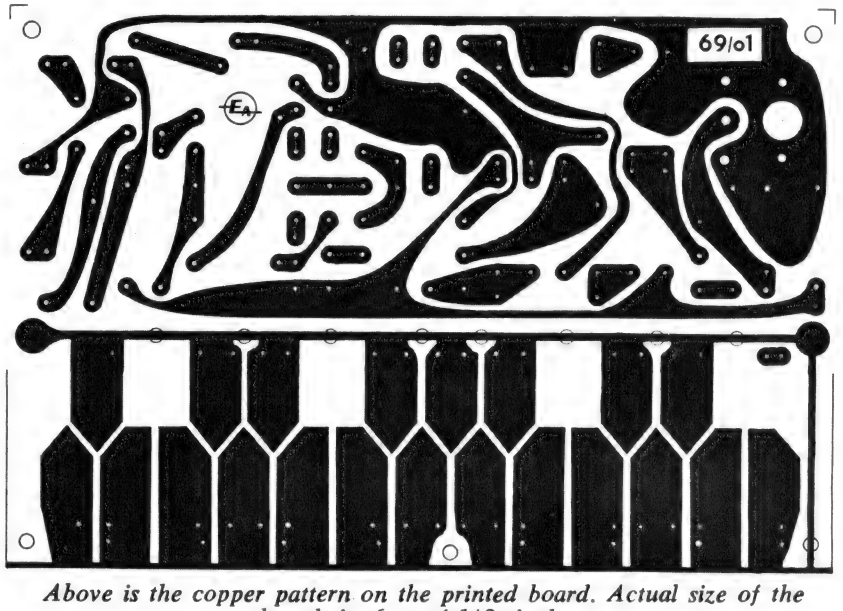
The speed of the vibrato may be varied by changing the value of the 1.8K resistor. Higher values will give lower frequencies and vice versa. The oscillator will not function reliably with values below 1K.

CONSTRUCTION: All the circuitry described above, apart from the slide switches, potentiometer and two small capacitors, is mounted on a printed circuit board measuring 6 x 4½ inches.

The copper wiring pattern of the board warrants some explanation. The actual "key" contacts are part of the copper pattern, the area of contact exposed by the case — the playing area if you like — measuring 5⅛ x ⅞ inches. Since copper tarnishes quickly when exposed to air, contact with the metal probe would be unreliable. For this reason we had a section of the contacts plated with gold. The area to be plated measures approximately 1 x 5½ inches. For the gold plating operation all the contacts must be connected together but the connections must be broken before the board is ready to be used. The "natural" keys are connected together by a strip along the edge of the board; this can be removed by chamfering with a file or abrasive wheel.

The "accidental" (sharp or flat) keys are connected by a strip down the centre of the board and these connections are broken by drilling with a 1/8-inch drill in the approprate circle markings. It is not necessary to drill right through the board, as we did with the prototype. To make sure the connection has actually been broken it is a good idea to slightly chamfer the holes. Readers may notice that the above-mentioned holes in the prototype are not in a straight line but they can be so in the production boards that you will ultimately buy.

Some readers may wonder whether gold plating is justified, in view of the cost. While other metals, for example chrome, may not tarnish, they



Above is the copper pattern on the printed board. Actual size of the board is 6 x 4-1/8 inches.

would not provide as reliable an electrical contact. Chrome relies for its non-decaying properties on a tough, transparent oxide coating which protects it from the atmosphere.

The printed board, with gold-plated section, will be available from R.C.S. Radio Pty. Ltd., 651 Forest Road, Bexley, N.S.W. soon after this issue goes on sale. It may also be made available by other advertisers.

The probe used to play the prototype instrument was a standard meter probe. The tip should be smooth and with a radius of at least 1/16-inch. A minimum pressure should also be used to avoid undue marking of the gold surface. The lead for the probe is brought out through a hole in the case which should be fitted with a grommet to avoid chafing the lead insulation.

The tuning capacitor used in the prototype was model PVC-P22, made by Elcom Manufacturing Company Ltd. It is a solid dielectric tuning capacitor meant for pocket radio applications. The oscillator and aerial sections give a maximum capacitance of 200pF when connected in parallel. Other solid dielectric tuning capacitors could possibly be used if they had around the same total capacitance, but the board may have to be modified to take them.

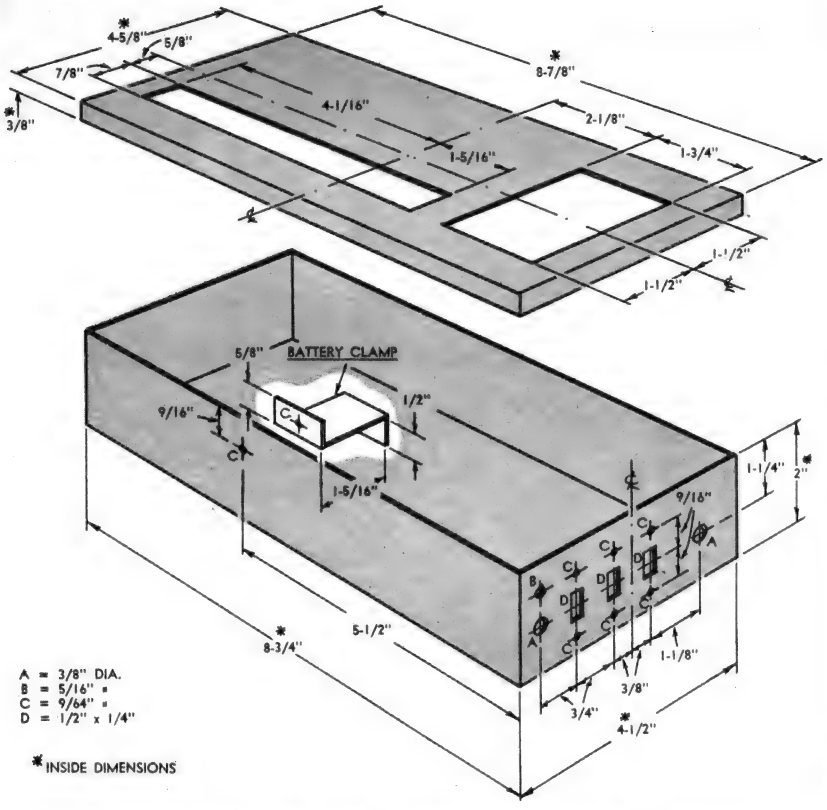
The tuning capacitor is fastened to the board by two small screws. A hole is drilled in the lid, in the appropriate place, for screwdriver access to the shaft of the tuning capacitor. The shaft must be fitted with a screw which is obtained with the capacitor.

All the resistors in the circuit can be of ¼ or ½ watt rating apart from the two emitter resistors for the output transistors, which are a new Philips cracked carbon type of ½ watt rating. We have used a mixture of ½ and ¼ watt resistors in the prototype. The resistors in the series string for the PUT oscillator should be high-stability types with a tolerance of not more than plus or minus 5 per cent.

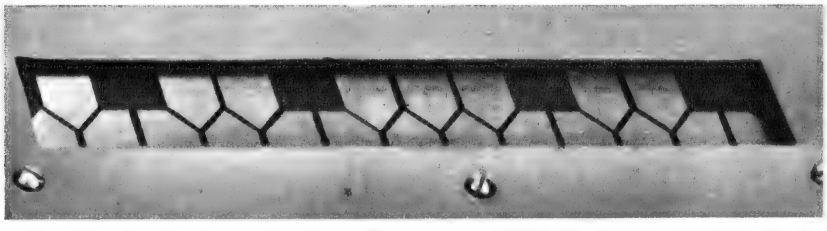
The holes on the board for the FET are placed in a straight line. Because of the different lead configurations on the two FET's the source and drain connections of the 2N4360 will be reversed to that shown on the wiring board, which shows the connections for the MPF-105 FET. This is immaterial since no DC polarising voltages are present in this section of the circuit. This means that the 2N4360 can be inserted directly into the board without having to twist the source and drain leads so that they conform to the wiring and circuit diagram. The FET actually installed in the prototype in the photos is a 2N4360.

The 1uF capacitors in the phase shift oscillator are mounted vertically to save space. Use polyester capacitors with the lowest available voltage rating, in the interest of the smallest size.

A word on soldering is appropriate here. The aim is to make quick, clean soldered joints in order to avoid overheating the components and possible damage to the copper on the board. Use a small, low-powered iron for best results. Some readers may find that the transistors and other "difficult" components are easier to install and solder if they are pretinned.



The above diagram shows the major details of the case.



A close-up of the "key" contacts. The pattern is designed to aid recognition of the notes, which are arranged like a piano keyboard.

The board is attached to the case lid by five 1/8-inch Whitworth screws and nuts, spaced off the lid by about 1/8-inch. The cut-out for the keys measures 5¼ x ¼ inches. The board should be positioned on the lid so that it does not foul the case. Details on the metalwork diagram will show the dimensions necessary for readers to make their own case but we presume that kit supplies will make cases and other parts available in due course.

The speaker is made by Manufacturers Special Products Pty. Ltd., serial number 4-2LB/15 and is a standard type available ex stock. The battery is made by Eveready, type 2364.

The Motorola FET, MPF 105, if not available from parts suppliers, may be obtained from Cannon Electric (Aust.) Pty. Ltd., 58 Cluden St, East Brighton, Vic., 3187, or P.O. Box 25, Mascot, N.S.W., 2020, or Commonwealth Aerodrome, Parafield, S.A. 5106. Similarly, the General Electric PUT, D13T1, can be obtained from Watkin Wynne Pty. Ltd., 32 Falcon St., Crows Nest, N.S.W.

The case can be painted a bright colour to provide a contrast with the gold-plated key contacts and the expanded metal speaker grille. The colour of the prototype was a mid blue.

SPECIFICATIONS

Pitch Range	A-220Hz to F-698Hz.
Supply voltage	9 volts.
Idle current	20mA.
Maximum current	90mA.
Power output	400mW(RMS).
Output signal to ext. amp.	300mV (RMS).

OPTIONAL FEATURES: In anticipation of correspondence on this subject are outlined some of the features which could be incorporated or deleted. The tuning capacitor can be deleted. The unit will still be in tune itself but could not be tuned to suit other instruments. The .0033uF timing capacitor could be changed to a higher or lower value to give an octave range to suit the constructor. Operation with capacitors below 1000pF may be unreliable, however.

The vibrato section can be deleted and the source-drain resistance of the FET replaced by a resistor with a minimum nominal value of 180 ohms. This will give the amplifier an effective input sensitivity of 300mV, as mentioned earlier.

The amplifier itself, with the associated volume control, can be deleted and the signal fed to an external amplifier via the output socket. The tone switch could also be deleted.

We urge readers not to deviate from the published circuit, apart from those possible modifications listed above, unless they are experienced constructors. We hope you derive as much entertainment from this unit as we did in developing it. ■

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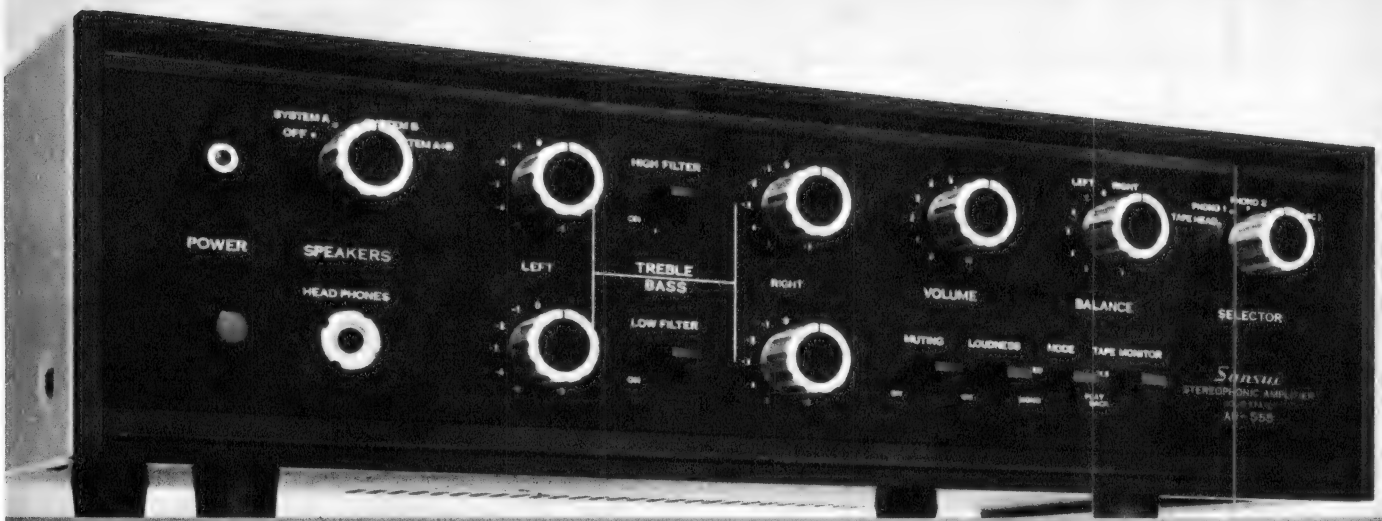

AU-555 SPECIFICATIONS

Main Amplifier Section
Music Power (IHF): 60 watts ±1db at 4Ω
Continuous Power: 25/25 watts ±1db at 4Ω
Harmonic Distortion: less than 0.5% at rated output
Power Bandwidth (IHF): 20 to 30,000Hz at 8Ω
IM Distortion (60Hz : 7,000Hz): less than 0.8%
Hum and Noise (IHF): better than 100db
Damping Factor: 12 and 45 at 8Ω
Pre-Amplifier Section
Output: 1V
Hum and Noise (IHF):
  Phono 1 and 2: 80db
  Tape Head: 75db
  Aux 1 and 2: 80db
Input Sensitivity:
  Phono 1: 2mV
  Phono 2: 2mV
  Tape Head (19cm/s): 1.5mV
  Aux 1: 200mV
  Aux 2: 140mV
  Tape Monitor: 150mV
Power Voltage: 100, 117, 220, 240V; 50-60Hz
Power Consumption: 120VA max.
Dimensions: 15″(W) × 4⅜″(H) × 10⅞″(D)
Weight: 17.4 lbs.

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AU-222 SPECIFICATIONS

Music Power (IHF): 46 watts ±1db at 8Ω
Continuous Power: 18/18 watts ±1db at 8Ω
Harmonic Distortion: less than 0.8%
IM Distortion (60Hz: 7,000Hz): less than 0.8%
Power Bandwidth (IHF): 20 to 20,000Hz at 8Ω
Hum and Noise (IHF): better than 80db
Damping Factor: 20 at 8Ω

Input Sensitivity:
- Phono 1: 2mV
- Phono 2: 2mV
- Tape Head (19cm/s): 1.5mV
- Aux 1: 150mV
- Aux 2: 150mV
- Tape Monitor: 150mV

Power Voltage: 100, 117, 220, 240V; 50-60Hz
Power Consumption: 100VA max.
Dimensions: 11½″(W) × 4⅜″(H) × 10½″(D)
Weight: 12 13/16 lbs.

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The Serviceman

BEWARE OF THIS SET — IT BITES!

From time to time I am reminded — quite forcibly in some instances—of just how dangerous is the combination of the power mains and the ignorant handyman who insists on fiddling with power plugs and cables.

One reminder came in the form of a letter from a reader, Mr C. T. of Malvern, S.A. Mr C. T. describes himself as ". . . servicing radio and TV sets as part of my job." He writes as follows:

"One of the two complaints accompanying a particular TV set was that it worked O.K. in one room but, when plugged into a power point in another room, it refused to work. The owner had run an extension cord from the first power point in order to use it in the second room. They had used other appliances in the second power point and all had functioned satisfactorily.

"Investigation showed that some time in the past the semi-rotary power switch on the rear of the volume control pot. had failed and had been replaced. When the wiring had been reconnected to the switch each wire had been moved around the terminal configuration by one terminal, in a clockwise direction.

"The amazing thing is that, by a series of coincidences, the set appeared to function normally. It switched on and off from the volume control switch and the spot swallower circuit continued to function. It was only when the set was plugged into another power point, having the active and neutral connections reversed, that the error showed up. It is necessary to refer to the accompanying diagrams to understand just how this came about."

In this case the problem was mainly one of convenience, and no dangerous situation had occurred. Which is not to say that it could not have done so, had the situation been favourable. In particular, failure of the earth cable in the power cord could have left the whole chassis floating at 240 volts; a lovely object to be caught holding with both hands!

Mr C. T.'s letter was received a couple of months ago, but pressure of other stories prevented my presenting it earlier. In the meantime I encountered a somewhat similar situation on my own workbench, and decided that it would be appropriate to present both stories together.

The equipment involved was a "Playmaster 101" amplifier, which the owner explained he had acquired soon after it was described (around 1962) and that it had been used quite regularly ever since. He now suspected that the valves were showing signs of wear and requested that I check these, and give the whole thing a general "once over" as well. He also mentioned that the system, while very good in all other respects, had always suffered from a slight hum. He wanted me to check out this aspect of it as well, and do what was necessary to fix it.

In fact, this made me somewhat suspicious. I knew the design well enough to know that it should be virtually hum-free. Therefore, a unit which, as the owner put it, had always suffered from this problem must have some fundamental fault. To this extent at least I was prepared for something unusual.

I checked the valves first, and they did turn out to be in the "doubtful" region, so I replaced them all. Then I prepared to give it a more detailed check. I turned it upside down on the bench so that I could make a voltage check, and connected a dummy load in place of the speaker in preparation for a power output check. Then I plugged in the power cord, switched on, and reached for the CRO leads. Among other things, I wanted to be able to see and measure any hum content before I started looking for likely causes.

But as I tried to clip the earthy lead of the CRO on to the chassis of the amplifier there was an almighty splat; the kind of splat which can come from only one source, the mains. The alligator clip on the end of the CRO lead was blackened and minus several teeth. The chassis had a small crater, surrounded by a black ring, in its otherwise clean surface. And I was temporarily dazzled and shaken.

Without more ado I pulled the plug from the power socket and checked. Sure enough, the green lead, instead of going to the earth pin, was connected to one of the potentially active pins.

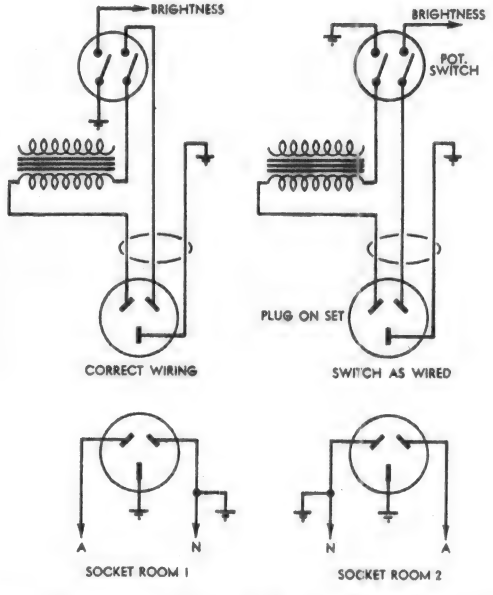
A quick check at the other end of the cable showed that it was correctly connected at the chassis end, i. e., the green lead to the chassis.

To quote an old music hall gag, had there been a chair handy I would have sunk heavily into it and sat stunned for several minutes. But seriously, the incident did rock me. I had had on the bench before me a live chassis, just waiting to bite. I had, in fact, handled it while it was alive. The only reason I had not felt anything was because I had not made any connection to an earthed object. Had I been grasping the chassis when I reached for that earthed CRO lead . . .

I rewired the power plug, double checked everything, then tried again. This time everything went well. The amplifier delivered normal power output, gave a clean signal on the CRO, and revealed no sign of hum, on either the CRO or a speaker.

This wasn't really surprising, when one comes to think about it. Compared with the "earth loops" which audio enthusiasts fuss over, and which amount to no more than a few inches in an average wiring configuration, this set-up must have been the grandfather of all earth loops. Even assuming that the neutral line was earthed at or near the entry point of the power line (M.E.N.) and that the earth wire was earthed at the same point, such a loop would probably be 20 or 30 feet long.

The worst conditions would occur when other appliances were being used on the same power line run within the building, and drawing current through



A freakish mistake by whoever replaced the switch pot made this TV receiver sensitive to the polarity of the power point. When connected to the socket in room No. 1 it functioned normally, but would not operate from the socket in room No. 2.

the same neutral line. In these circumstances a 50Hz voltage would be developed along the neutral line, between the earth point near the meter and the neutral pin in the power point, by reason of the simple fact that a current was flowing through a resistance. Admittedly, this would be measured in fractions of a volt, but fractions of a volt can play havoc if they are introduced into the early stages of a high-gain amplifier.

From this point on, beyond pointing out that the chassis of the system would be moving up and down at 50-Hz, with respect to the true earth, by the voltage developed along the neutral line, I would not like to try explaining the exact mechanism by which the hum found its way into the signal circuits. All I know is that (1) random earth loops of only a fraction of this size can cause endless trouble and (2) restoring the power connections their proper configuration cured the hum in this case.

When the owner came to collect the amplifier, I tackled him about the transposed power leads. At first he denied all knowledge of it, claiming that it had been like that since he bought it. But when I expressed doubts that a piece of equipment would be sold in that condition, he suddenly recalled that the original power cord had been too short and that he had replaced it with a longer one.

'Nuff said.

Not long after this, while servicing a TV set, a housewife tackled me with a question, "Why will my iron work off the power point in the kitchen, but not off the one in the laundry?"

Coming hard on the heels of my own experience such a question was enough to give me the horrors; and all the more so because the location in which the iron would not work was one providing ample opportunity for the user to become "earthed." Just by touching a tap, leaning against the washing machine, or simply standing on the concrete floor.

"You'd better let me have a look at it," I replied, "or it may not be the only thing around that isn't working." And from the look on her face I knew she had grasped my meaning. I make no apology for scaring people in these situations. Better a scared customer than a dead one.

Naturally, the fault was exactly what I expected; the green earth lead transposed to one of the potentially active pins. This, combined with an old electrical installation in which the active/neutral disposition in the power points was quite random, accounted for the symptoms. In the kitchen power point the iron element was connected between active and earth, with the frame connected to neutral. Thus the iron worked, and was relatively safe. In the laundry power point the element was connected between the neutral line and earth, while the frame was connected to the active line. Thus the iron would not work, but the frame was alive and ready to deliver a lethal shock to an unsuspecting user.

As a final word on the safety angle, I was interested to note a small par in the "Scientific and Industrial News" in the December issue (Page 37). It records an agreement between most of the European countries, including Britain, on the colours to be used in electrical appliance cords. These are: Active, brown; neutral, light blue; and earth, green and yellow striped. It will be interesting to see whether other countries, including Australia, decide to fall into line. World-wide agreement on this important standard — important because people's lives depend on it — should not be too much to hope for.

To change the subject abruptly, here is a story related to me by my amateur friend. It seems that he made a recently holiday trip to Queensland, and equipped his car with a 14MHz mobile system for the journey. At Southport he stopped in the main street to call on an old friend, who works in one of the shops.

After the usual preliminaries, he invited his friend out to the car to see the "mobile rig." While he was showing it off a VK3 called "CQ" with an S9 signal, and my friend immediately prepared to reply.

Meanwhile, a vacant-eyed, slack-jawed youth was lounging against the nearby shop front, arm bent at the appropriate angle to hold his "transistor" against his ear. (How I hate the way that word has been mutilated.)

As the VK3 completed his call, my friend pressed the transmit button. As he describes it, the youth's set made a kind of a "phut" noise and went dead. The youth's expression became even more vacant—if that is possible. He looked at the set, shook it, slapped it, and twiddled the knobs. It was no use, the set was dead—permanently. The youth wandered off, presumably in search of the nearest serviceman.

Some weeks later, back from holidays, my friend was conducting mobile experiments with his car parked in his driveway. He hardly noticed the youngster walking down the street, and was even less conscious that he was carrying a radio. All he was aware of was the now-familiar "phut" sound as he pressed the transmit button, followed by the look of surprise on the owner's face, and the ritual of shaking, bashing and twiddling.

"I was sorry about that," said my friend. "I wouldn't have done it deliberately."

"Maybe not," I replied, "but I know a lot of people who would have no such inhibitions. Make those things small enough to take to the beach or carry in the train, and they'll sell like hot cakes."

Seriously, what does this mean? We can only assume that the amount of power intercepted by these receivers was just too much for the first stage. Transistors, unlike valves, are not particularly tolerant to short term overloads. Whereas valves merely distort, transistors may break down.

When this story was related to a third colleague, he added a very interesting comment. He is a technician in a large organisation and, from time to time, makes repairs to staff radio sets—strictly unofficially, of course. He commented that a significant proportion of the pocket radios he has repaired in the past 18 months have suffered from the same fault; the inexplicable failure of the first transistor. I wonder?

While there is a lot of conjecture in all this, I am prompted to ask just how serious the situation is, or is likely to become. What of the hundreds of mobile transmitters, including taxis and the like, which roam our city and suburban streets? Are they all potential "transistor killers"? And what about the first stages in expensive audio equipment? Are they equally vulnerable and, if so, what are the equipment manufacturers going to do about it?

And let there be no misunderstanding in this regard; the responsibility lies fairly and squarely with the equipment manufacturer. In no sense is it the responsibility of the person using the transmitter, whether it be amateur or commercial. Provided the transmitter is operated within the limits of its licence, in terms of power, frequency, and freedom from spurious emissions, the operator has discharged his responsipility in the matter. The rest is up to the equipment manufacturer. ■

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KEEPING UP WITH semiconductors

. . . "Transient Protected" Diodes

A typical semiconductor power rectifier diode, as illustrated in figure 1, consists of a diffused P-N junction chip hard-soldered to a header which forms part of a small metal case. The N-type side of the chip is normally connected electrically to the case, to form the cathode connection, while an "S-shaped" wire or spring strip connects to the P-type side to form the anode connection. The interior of the case is typically filled with an electrically inert paste or gas.

The intrinsic ability of such a diode to withstand high reverse voltages without suffering permanent damage tends to be rather poor, even when the voltages concerned are "transients" lasting only for very short periods. The reason for this is that when the device enters the condition of reverse voltage breakdown, it does so in an uncontrolled and potentially self-destructive fashion. The tolerance of such devices to voltage overload is almost completely a function of whatever protection is afforded by the associated circuitry, either by accident or design.

One factor which contributes to this behaviour is that the average thermal resistance between the P-N junction and the case exterior is relatively high. As a result, heat generated within the junction when it enters the high-dissipation breakdown condition tends to cause excessive temperature rise and consequent damage to the semiconductor crystal structure.

A second factor and one which complements the former is that when breakdown does occur, it tends to occur not in a distributed manner throughout the cross-section of the P-N junction, but rather as a localised effect at a "weak spot" provided by a discontinuity in the crystal lattice, a "lump" or "void" in the impurity diffusion distributions, or some other defect. Often the weak spot concerned is at or near the edge of the chip where the junction meets the surface, due to the considerable difficulty involved in preventing surface contamination of the chips during diode fabrication.

As a result of these factors the breakdown of a typical junction diode tends to follow a "snowball" pattern, with localised temperature rise due to initial breakdown current causing junction damage and resulting in further current flow, increased dissipation, further damage, and so on. If the external circuit is such that sufficient current can flow, the diode rapidly destroys itself.

From the foregoing it should be fairly clear that a diode's tendency to behave in this fashion will be at least partly proportional to the thermal isolation of its junction. Hence one would expect that at least a partial improvement would result if the diode construction were altered to reduce the thermal resistance between the P-N junction and the case exterior (or "ambient"), and this is quite true.

Accordingly many manufacturers have recently produced improved

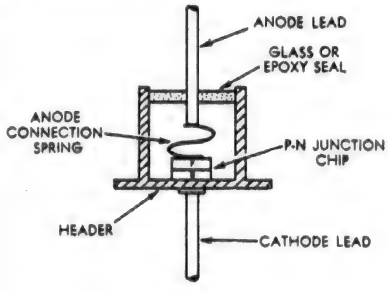

Figure 1

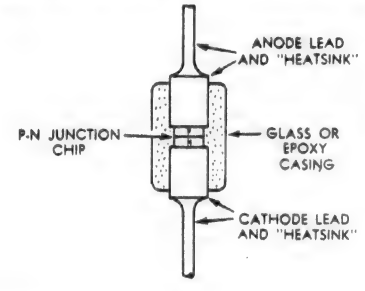

Figure 2

diodes featuring a "double - heatsink" construction, in which the anode and cathode connections are arranged to be of low thermal resistance and in intimate contact with the semiconductor chip. The construction of a typical diode of this type is illustrated in figure 2.

While this approach gives a significant improvement in the tolerance of the device to over-dissipation damage, it does not help greatly in protecting the device against damage from short-duration reverse-voltage transients as are experienced by rectifier circuits connected to the AC power mains. Ultimately the attack on the latter problem lies in reducing or removing altogether the "weak spots" in the semiconductor chip, so that in the ideal case breakdown dissipation is distributed evenly over the complete junction and not localised.

After considerable effort in this direction, semiconductor diode manufacturers have recently achieved a fair order of success. By combining the "double - heatsink" construction with controlled "passivation" techniques to prevent surface contamination of the semi-conductor chips, and by employing considerably more rigid controls over semiconductor metal purity, impurity refinement, and manufacturing processes, they are now able to provide the new generation of "transient voltage protected" devices.

Because of the almost complete absence of "weak spots" in such devices, the application of high-amplitude reverse voltage transients merely causes them to enter a well-controlled and evenly distributed avalanche breakdown. This type of breakdown is non-destructive providing the device dissipation limits are not exceeded, being essentially identical to the "normal" operating condition of the familiar "zener" regulation and reference diode.

As a result of their greatly improved tolerance to transient voltage overload, the new devices are highly suitable for use in applications where reliability is of prime or vital importance. Their ability to enter non-destructive avalanche breakdown also permits them to be used, in simple series configurations, to provide effective peak-inverse-voltage (PIV) capabilities far in excess of single devices. (J.R.)

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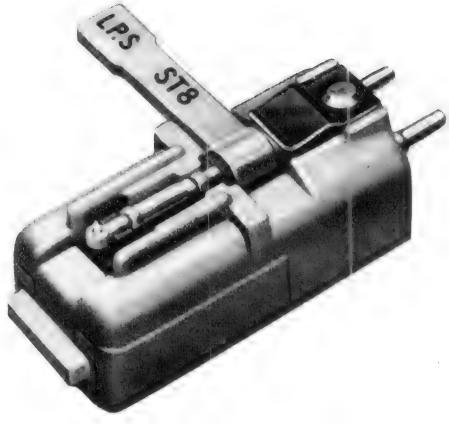

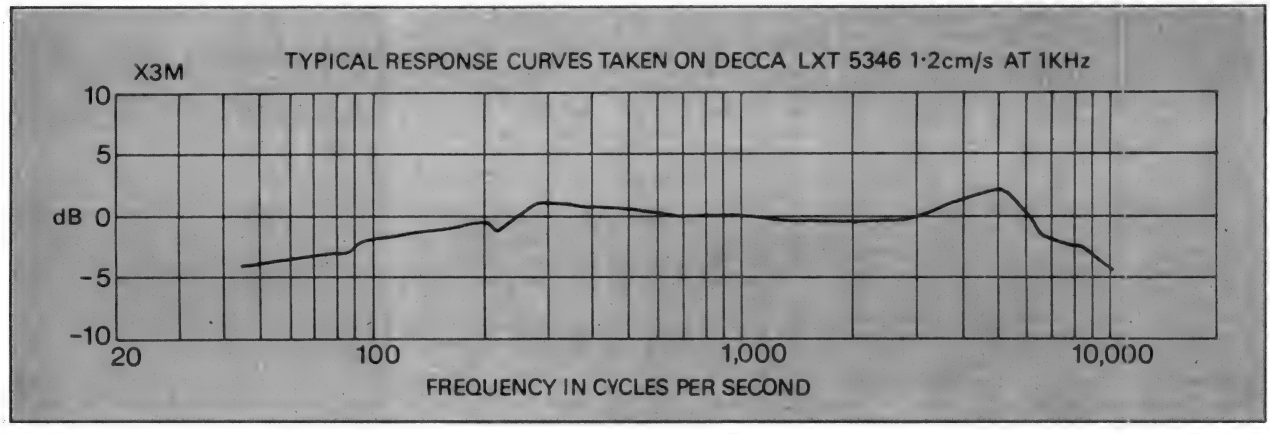

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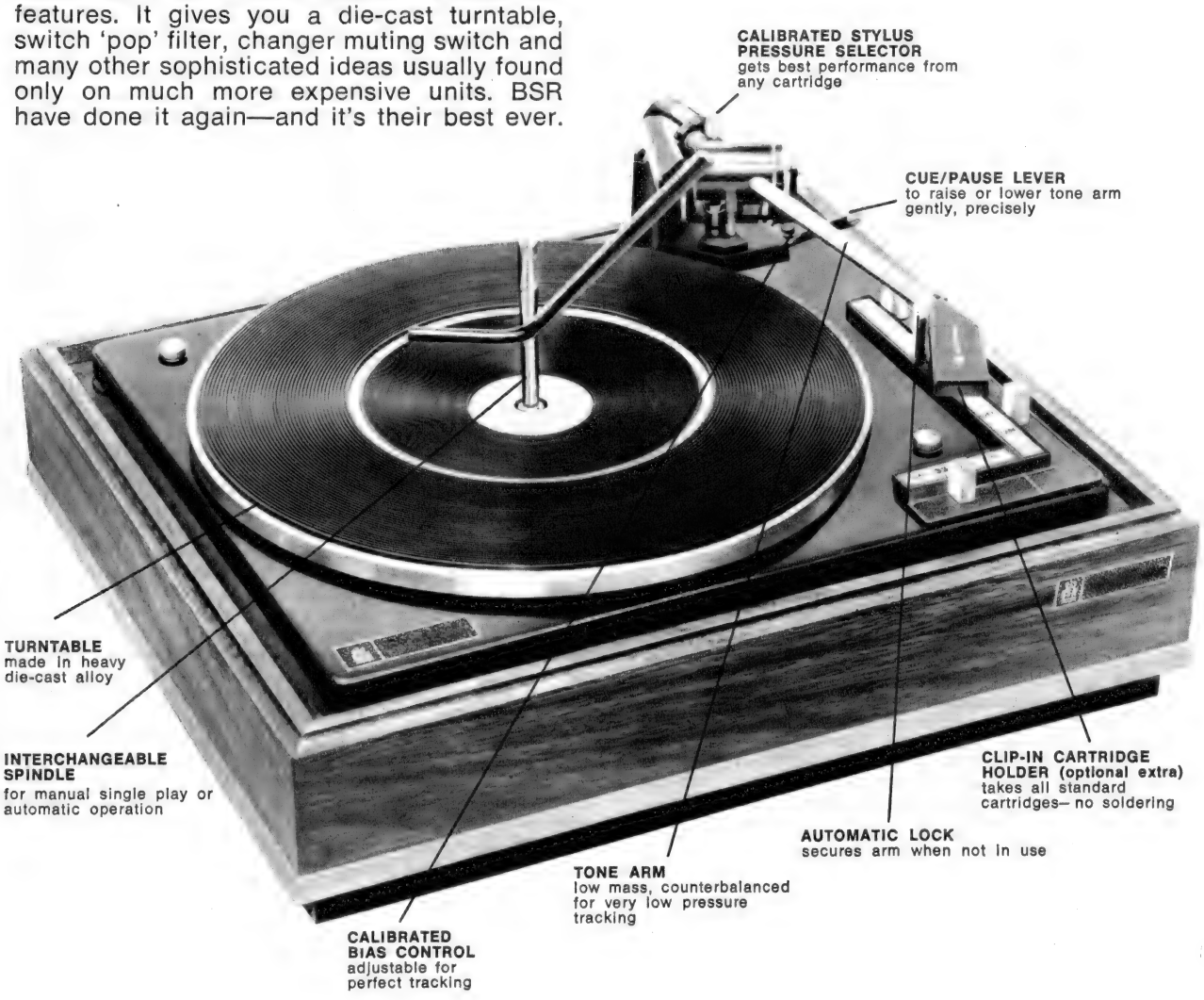

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A Beat Frequency Oscillator for your short-wave receiver

With interest in short-wave listening just as great as ever, we have been asked several times recently for details of how to fit a beat frequency oscillator to an existing short-wave receiver. While this is not always easy or completely satisfactory, the following article should indicate what needs to be done and what results can be expected.

By Ian Pogson

Requests for an article on beat frequency oscillators vary from those who wish to add one to a portable receiver, to cases where a serious short-wave listener has quite a good receiver which is not fitted with a BFO.

We have run up three circuits, two using transistors and one using a valve. Only one unit is shown in final form but sufficient information is given to enable readers to build up either of the others.

The main purpose in fitting a BFO to a receiver is to enable Morse code signals and SSB signals to be resolved. Morse code signals are frequently transmitted in the A1 mode. This applies particularly to the amateur bands, where it is the only morse system permitted on many bands. Such a signal is not modulated; it is simply bursts of carrier keyed on and off in acordance with the code symbols. Without a BFO the received signal will appear as a series of thumps or may not be audible at all.

To resolve the signal properly, we need to "beat" it against a locally generated signal, suitably offset in frequency so that the difference between the two is equal to an audio tone, or "beat note."

SSB signals also need a BFO in order to be received correctly. A normal AM signal is radiated as a carrier and two sidebands, and can be resolved with very simple equipment. The SSB signal has one of the sidebands and the carrier suppressed at the transmitter, leaving only one sideband. There are a lot of advantages in this system, but it does require special facilities in the receiver. In particular, it requires that the missing carrier be re-inserted, and this is the purpose of our BFO. Without proper treatment, the signal as received will be quite unintelligible, and is aptly described as "Donald Duck talk" or just "duck talk." The main problem with SSB is that the re-inserted carrier must be very carefully adjusted and maintained.

The BFO signal is normally generated at the intermediate frequency, and injected into the system at some convenient point in the IF chain up to or at the detector.

Before going into details of the circuits, perhaps it would be wise to have a look at the problems which may be encountered in the process of adding a BFO to a receiver which was not designed with the idea of BFO reception in mind. In short, receivers designed primarily for the reception of AM signals.

Communications receivers of just a few years ago had BFOs installed as a standard facility, injecting the output into the detector, where it was mixed with the IF signal to give the required audio beat note. Or, in the case of SSB reception, the BFO frequency was adjusted against the incoming signal, to "resolve" the SSB signal into the intelligible signals.

Such receivers are normally fitted with an AGC system and the very fact that the BFO signal is injected into the detector circuit results in this signal finding its way into the AGC circuit. This generates an AGC control voltage of its own and so reduces the sensitivity of the receiver accordingly. To avoid this problem, the receiver may be fitted with a switch which shorts out and so disables the AGC system.

Switching off the AGC certainly avoids this problem and the sensitivity of the receiver is restored to maximum. But it introduces another problem! With even moderately strong signals, the receiver can be grossly overloaded. To avoid this problem, a manual RF and IF gain control can be added. The technique then is to manually reduce the sensitivity of the receiver to the point where overloading does not occur. This creates yet another problem; how do we combat fading? The simple answer is that we do not. We must live with this one, but it is not always a serious matter.

In passing, it is interesting to note that in modern communications receivers, all these problems are solved. The AGC is left on and works just as well on SSB, Morse code and AM signals alike. The secret lies in a technique injecting the BFO signal into the detector and, at the same time, prevent it from upsetting the AGC system.

From the brief description of the difficulties encountered when a BFO was used in older communications receiver, it will be clear that there is more to fitting a BFO to an existing receiver than may at first have been supposed. Generally speaking, there will be no room to build a BFO into the existing set, no facility for switching off the AGC system, and no provision for manual RF and IF gain control. In some cases it may be possible to make modifications to the existing receiver, to accommodate all these desirable features. On the other hand, it may be difficult or impossible to make any alterations at all.

Even if you have a receiver which does not lend itself to any alterations at all, we will show, later on, that it is possible to use a BFO to advantage, although it may not be possible to obtain full benefit from it.

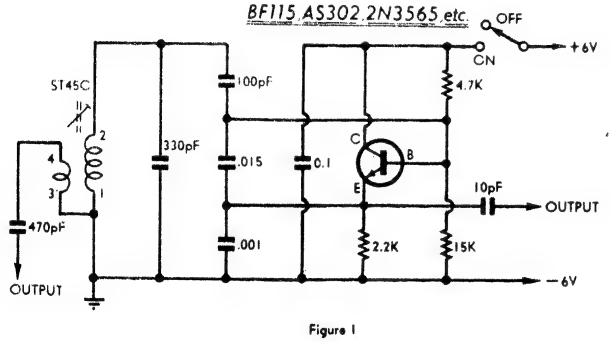


Figure 1

This is the circuit of the transistor BFO as described in full in this article. Two alternative outputs are shown, one low and the other, medium impedance. The low impedance output is not really necessary and may be omitted.

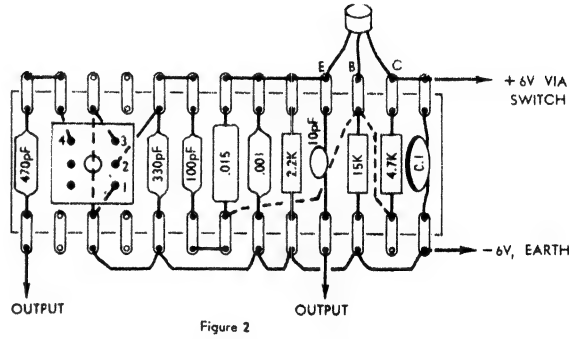


Figure 2

This diagram gives wiring details for the circuit at left. The IF transformer which we used was small enough to be wired directly to the board. If you use a larger coil, then it may be necessary to mount it separately.

Figure 1 shows the circuit of the BFO which we have built up into its final form. This circuit may be familiar to some readers, having been featured in an article in the magazine in October, 1966. It is an adaptation of an oscillator described by Commander Lee in CQ magazine, in September, 1963. The circuit is very stable indeed and is ideal for our purpose. In spite of its excellent performance, it is simple and easy to get going.

If you take a closer look at the circuit, you will notice that the coil does not need any tap and this makes it possible to use many different coils which readers may have on hand. The coil which we have specified is a miniature IF transformer, currently made by Aegis. It is designed to tune to 455KHz with approximately 400pF across the primary winding, and has a low impedance secondary winding which may be used as an alternative output from the oscillator. More will be said about this later on.

Many IF transformers used for valve receivers are tuned with 100pF across the windings. These transformers, many of which may be in junk boxes, have two tuned windings. Only one winding is needed. Both 100pF capacitors should be removed and one winding can then be wired into the oscillator. It is important that the unused winding be disabled by removing its capacitor. When this type of transformer is used, the 330pF capacitor shown in the circuit, is omitted.

The transistor for this oscillator may be any silicon NPN type which is capable of operating at the required frequency. Types such as the BF115, AS302, 2N3565, etc., are suitable. The four capacitors associated with the tuned circuit, 100pF, 330pF, .001uF and .015uf, should all be of good quality. Polyester, polystyrene, or silver mica types would all be satisfactory. Do not use ceramic types, other than NPO. New components should be used here, rather than some retrieved from the junk box.

With the exception of the battery supply and the ON/OFF switch, the components are wired on a piece of miniature tag strip. This can be seen from the photograph and the component locations can be seen in figure 2. We have included both output points, whereas builders will more than likely only include the one which is going to be used.

The board should be wired up with normal care, making sure that the components are not overheated in the process. This applies particularly to the transistor. The soldered joints should be carefully made to avoid any possibility of a dry joint. It is also important that the components are firmly mounted so that they will not be subject to vibration, with consequent frequency instability.

A power supply source of between 4.5 and 9 volts DC is required for the oscillator. This may be obtained from batteries or any other source of well filtered and regulated DC. The output voltage from the oscillator will be almost directly proportional to the supply voltage. We used a 6 volt supply from a set of four No. 1015 dry cells, mounted in a compact holder. It may be worthwhile experimenting with the supply voltage, to control the required output. However, this should not be necessary, as will be seen later.

We mounted the completed board, together with the battery container, switch and output terminal, in a die-cast box measuring 4 5-8in x 3 5-8in x 2 1-8in. This box is made by Eddystone and is readily available for a reasonable price. Although it is somewhat larger than necessary, it allows plenty of room for all components, without being too large. In any case, the type of box used is largely up to the builder, but it is important that it be metal for shielding-purposes. At the point of greatest economy, a box could be fashioned from the tinplate of an old preserved fruit tin.

For readers who wish to experiment with an alternative circuit, we suggest figure 3. This circuit is also capable of performing well. If you look at it closely, you will notice many familiar aspects. Basically, the circuit is a modification of the well-known cathode-coupled multivibrator. Another inspection will reveal that this amounts to an emitter-follower, feeding a grounded base amplifier. The latter has a tuned circuit introduced as the load in the collector circuit and this is the frequency-determining part of the circuit. As a matter of further interest, it also has similarities to a Butler crystal oscillator, the crystal being omitted and the cathodes tied together.

Apart from adhering to the component values given in figure 3, the tuned circuit is subject to alterations to suit the individual. We have specified an Aegis type ST45C IF transformer, similar to that used in the circuit of figure 1. The same comments as we made previously apply here if you wish to use a suitable coil or transformer which you happen to have on hand. In common with figure 1, we have also shown two output points.

This circuit may be built on a piece of miniature tag strip, as with the other one. Layout is not important but all other comments relating to the workmanship still apply.

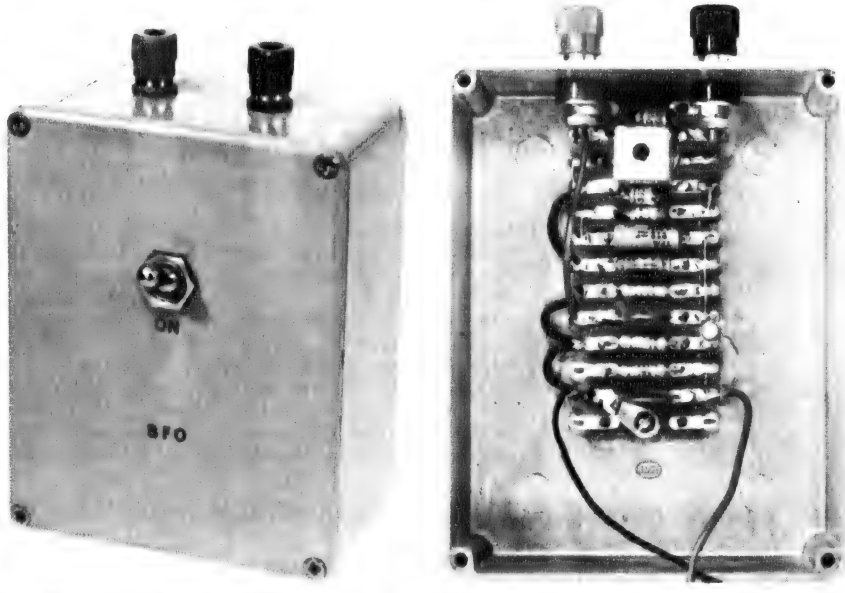
Whether you make up the circuit of figure 1 or 3, the application will be exactly the same. As a guide to builders, here are some of our observations and ideas which we have formulated after practical investigations. How you can best make use of the BFO will depend to a very large extent on the receiver being used.

Initially, we tried it on the 1967 All Wave Seven valve receiver. Although this has a BFO and heterodyne detector built in, we did not use these facilities. Instead, we left the function switch in the "AM" position and tried various ways of injecting the output of the BFO into the receiver.

The simplest method is to run a lead from the BFO and connect it to, or bring it near to, the aerial terminal. Sometimes, there can be sufficient breakthrough across the front end of the receiver, or radiation into the IF

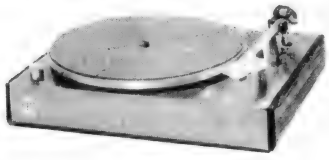
PARTS LIST

1 Metal case (see text).
1 Toggle switch, SPST.
2 Terminals, 1 red, 1 black.
1 Miniature tag strip, 13 pairs of tags.
4 No. 1015 dry cells.
1 Holder for above cells.
1 Battery plug and leads.
4 Rubber mounting feet.
1 455KHz IF coil (see text).
1 10pF NPO ceramic.
1 100pF Styroseal.
1 330pF Styroseal.
1 470pF Styroseal.
1 .001uF Styroseal.
1 .015uF plastic.
1 0.1uF low voltage ceramic.
1 2.2K ½W resistor.
1 4.7K ½W resistor.
1 15K ½W resistor.
1 Transistor, BF115 or similar.
Screws, nuts, hookup wire, solder, solder lugs, etc.



We housed the prototype in a die-cast box, which makes a neatly finished product. A front view is shown on the left, with an inside view on the right. The battery, not shown, fits in the space below the wiring board.

WHY DOESN'T YOUR TURNTABLE LOOK LIKE THIS?



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The resonant frequency of the suspended mass is 2 cycles, which eliminates all vibrations above that figure, i.e., all the audible frequencies.

The arm can track at 1/10 gram.

The tracking weight is applied directly to the pivot by changng the angle of the blades. In this way the inertia of the arm is not increased with the tracking forces as in all other arms. The pickups sound better.

The arm itself is made of a light alloy H beam which eliminates the resonant frequencies of tubes.

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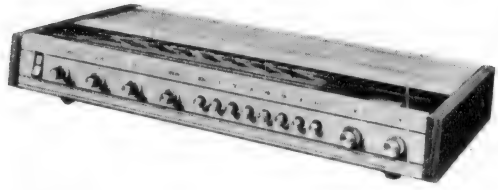

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Sound Dispersion: 360 degree below 450 Hz ● 140 degree up to 20,000 Hz.

Minimum Power Requirement: 20 watts.

Maximum Power Handling Capacity: 100 watts, undistorted.

Impedance: 8 ohms. **Height:** 29" ● **Diameter:** 22"

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amplifiers, to give ample injection. This was so in this case, with the receiver tuned to any frequency up to 5MHz, but was not successful above 5MHz. The reason is that the receiver is operated as a single conversion unit up to 5MHz and the 455KHz signal can get through. When double conversion is used above 5MHz, the BFO signal is rejected to the point where there is not enough injection.

Better results were obtained by making a loop in the wire from the BFO and dropping it over the first IF valve. This gave more than enough injection at all frequencies, with no limitation above 5MHz. Even dropping it over the second IF valve instead, gave sufficient injection.

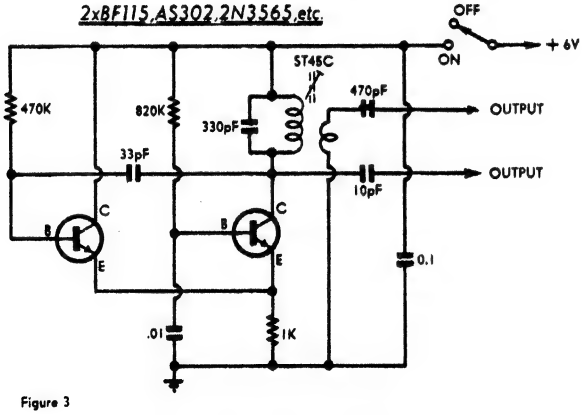

Figure 3

For experimenters, the circuit on the left may be tried. It is capable of a good performance. The same comments for figure 1 also apply here.

For readers wishing to make a valve type BFO, here is the recommended circuit. Comments for figure 1 regarding outputs once again.

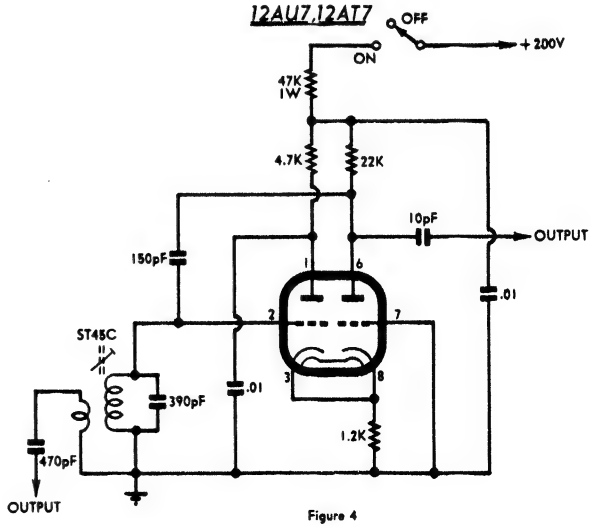

Figure 4

Still using the 1967 All Wave Seven Receiver, we injected directly into the diode detector via a coupling capacitor. The point of injection is at the junction of the IF transformer and the diode. Strictly speaking, this is the more conventional place where injection is effected. This provided adequate injection at all frequencies.

Perhaps a more difficult type of receiver to deal with is the better type of Oriental portable all-wave receiver. Once again, with the receiver tuned to the broadcast or the lower frequency short-wave band, we found that satisfactory injection could be obtained by wrapping the end of the insulated lead from the BFO around the base of the telescopic aerial.

This method was not satisfactory for the higher short-wave frequencies, so we gained access to the inside of the receiver by removing the back moulded panel. Without making any metallic contact between the receiver and the lead from the BFO, we simply pushed the insulated end of the wire into the "works" adjacent to the first IF transformer. This provided adequate injection at all frequencies. The alternative would be to inject directly into the detector on the board. As this would have been a major operation, we avoided it, particularly as it does not offer any worthwhile advantage.

As already implied, the amount of injection can be controlled somewhat by varying the position of the output lead with respect to the relevant components of the receiver. In these circumstances the 470pF and 10pF capacitors shown in figures 1 and 3, should be satisfactory. However, if metallic contact is to be made to, say, the diode detector circuit, then either of these values may have to be made smaller or larger, to obtain optimum injection. This also applies to the valve circuit of figure 4.

Our observations are that when a reasonable amount of BFO injection is achieved the "S" meter, when available, should read about half scale, without the influence of a received signal from outside. The receiver sensitivity is reduced but in spite of this, many weak signals can be received quite well. With much stronger signals, reception is also satisfactory. These comments apply to Morse code signals.

Instead of building the unit into a box, there may be room in the receiver, to fit it somewhere close to the detector. The components could still be mounted on a piece of tag board as we have done. Alternatively, as the layout of the BFO components is not critical, it may be more convenient to wire it into some other available space. Power for the oscillator is most easily provided by means of a battery.

When it comes to resolving SSB signals by this simple method, we are not so optimistic. Under rather special conditions, it should be possible to receive some SSB signals. However, the received signal would have to be about the right strength for the amount of BFO injection. A much more important point however, is the tuning rate and dial movement of the receiver. In most cases these would just not be good enough and the task of tuning SSB would be very difficult.

It would be possible to alleviate this situation somewhat, by adding a small variable trimmer across the tuned circuit of the BFO coil. This could be suitably mounted, with a knob to adjust the frequency of the BFO by a small amount, on each side of the centre 455KHz. Having tuned the wanted SSB signal as closely as possible, this trimmer could then be adjusted to resolve the signal properly. Even so, with many small receivers the stability of the local oscillator is not good, particularly at the higher short-wave frequencies. and the SSB signal may be difficult to keep in tune. In short, it would be wise to think through these problems before becoming over - committed and optimistic.

Another point which should be mentioned, is the fact that when the BFO signal is injected into the receiver, a rise in noise may be observed. This is normal and no further notice need be taken of this phenomenon.

For readers who have reasons for building a valve type BFO, figure 4 gives details of a circuit using a twin triode valve. This is rather similar to the transistor circuit of figure 3, with the main exception that the grid circuit is tuned, instead of the plate (or collector). The reason why this type of oscillator was chosen, in preference to the more conventional BFO circuits, using a single triode or pentode, is that it does not need a tapped coil and this circuit has proved itself to be reliable and stable.

As it is more than likely that this BFO is needed for a valve type receiver, then it may be possible and what is more, logical, to build it into the existing receiver. If this is done, it should be located near the detector or, if not, preferably nearer to the audio and power supply components. In any case, it should be located as remotely as possible from the RF and IF amplifier stages.

One possibility may be to dispense with the receiver's valve rectifier and replace it with silicon diodes. Not only will this reduce power consumption and heating, but the vacated hole could be used to mount the BFO valve. The rest of the components could be located nearby. As the heater and high voltage requirements are modest, more than likely the receiver power supply will be able to provide them.

If the existing receiver has an RF gain control, then it would be worth while adding a simple switch to disable the AGC system. This can be done by shorting the AGC reservoir capacitor to chassis. Then, by introducing sufficient injection from the BFO and adjusting the RF gain control, quite good results should be obtained, both on Morse code and SSB signals.

Forum

Industry should put up or shut up!

For years there have been complaints from within the electronics industry that the Australian Defence Department has too frequently shown a preference for overseas suppliers. With the national economy now moving in favour of local suppliers, the big question arises as to whether the electronics industry is going to be able to match its words with effective action.

Conducted by the Editor

This was the theme of a thought-provoking article by Peter Robinson in "The Australian Financial Review" for November 19, 1968. The article is reprinted here, not with the idea of endorsing every conviction and emphasis of the writer, but to encourage consideration of the points which he raises.

PETER ROBINSON SAYS:

Although there has recently been a major change in the Government's emphasis on the procurement of defence supplies from Australian manufacturers, a full awareness of the mutual responsibilities involved in this does not yet seem to have seeped down to industry.

In blunter terms, many senior defence officials feel that industry is not putting its production capabilities where its mouth was.

This criticism is felt to apply to a wide spectrum of Australian industries which have been demanding greater local procurement of defence needs — but the electronics industry is singled out as one which has been both the most vocal lobbyist and the one most reluctant to respond vigorously to the new Government approach.

In particular, the recent upsurge of electronics industry lobbying for the introduction of colour television has aroused anger among some defence officials.

On any scale of national priorities, colour television must rank pretty low —but at a time when Australian defence is sagging under the burden of heavy foreign-exchange payments it is felt that the electronics industry should be concentrating its efforts on upgrading its technology and improving its import replacement capabilities.

The failure of the industry to make any successful bid on the recent Intelsat IV sub-contracts called by Hughes Aircraft—bids which would have had the powerful and enthusiastic support of the Overseas Telecommunications Commission — has aroused a suspicion in Canberra that the overseas owners of the Australian electronics industry are not prepared to go beyond token efforts at developing an Australian-oriented defence technology.

In part, these doubts seem to be a development of the traditional suspicion which has consistently plagued the dialogue between Government and industry on defence procurement matters.

Industry feels that the Government is not really sincere when it says that every effort is made to buy all possible defence stores in Australia. It cites innumerable instances when Services have left procurement requirements so late that there has been no alternative but to meet them by "off-the-shelf" purchasing abroad.

It also cites stringent controls on profit margins and specifications which are often totally unrelated to commercial production standards as factors militating against whole-hearted co-operation in the defence production sphere.

For its part, the Defence establishment feels that it has a constant battle to interest industry in solving its problems and that all too many manufacturers are happy to accept defence orders when commercial demand is slack and they have surplus capacity but adopt a take-it-or-leave-it approach when consumer demand is high.

Like so many aspects of Government-industry relations in Australia, these attitudes are so deeply rooted in the past that they hardly have relevance to the present problems facing the country.

They have become a kind of conventional facade obscuring the development of a radically new series of problems on the defence industrial front.

In reality, Australia's changing military and financial circumstances have injected new dynamic factors on both sides of the defence-industry equation.

Yet the picture remains obscure because it is still being presented as a continuation of the age-old story — rather than a new situation in a new context.

Looking on both sides of the picture, what has happened is this:

On the defence side, the rising balance-of-payments problem created by heavy defence procurement abroad has coincided with a drastic change in Australia's position arising from Britain's withdrawal from Asia and developments in Vietnam.

Unavoidably, therefore, Australia must continue its defence build-up while at the same time trying to limit further spending of foreign exchange on defence stores.

This has created a situation where a "buy Australia" philosophy has become essential to all future military procurements. Traditional industry complaints that this is little more than lip-service are no longer valid.

There has unquestionably been a major upheaval in the Defence Department's approach to the whole question of local procurement. As reported in the "Financial Review" recently, not only will military procurement go to Australia wherever possible, but Australian content or offset orders will be sought wherever practicable when placing orders abroad.

But while the Defence Department is now absolutely serious about raising Australian content to the maximum possible level in overall procurement it has also undergone another, concurrent revolution in thinking.

In simple terms, the analytical, cost-benefit approach adopted by the U.S. Defence Department under Robert

McNamara is now being applied earnestly at Russell Hill.

A year ago, it was distinctly unfashionable to mention cost-benefit, systems analysis, war games, programmed budgeting and all the other tools used in McNamara-style defence economics to anyone connected with the Australian defence establishment.

To judge from the reactions such terms aroused in many Defence Department breasts, they represented heretical concepts threatening the doctrinal purity of traditionally trained military expertise.

Today, there is no doubt at all that Australia's defence establishment is moving with some sense of urgency toward an era in which essentially non-military skills of analysis, E.D.P. programming, war gaming and operations research will dominate both its strategic philosophy and its procurement programming.

Unless Australian industry understands this, it will soon be facing an even greater communications problem with the defence authorities than it faced in the somewhat rigidly military traditionalism of the immediate past.

The Defence Department is currently building up top-level analytical capability; it is hiring economists, programmers, analysts and psychologists.

Not only will the proposed purchasing programs of the individual services be examined with what one official called "a cold fish-eye" but contracts, specifications and the performance of individual companies will be viewed with both technical and economic expertise not previously possessed by the defence establishment.

This development coincides with the Defence Minister's hopes of obtaining more American sub-contracts for Australian industry.

They are, indeed, two sides of the same coin. Australian companies which are capable of satisfying the new rigorousness in Defence Department procurement will probably be well-equipped to tender for American sub-contracts.

On the other hand, Australian companies which feel unable to go out after U.S. contracts are likely to find themselves unable to meet new Australian requirements either.

In effect, the current Tariff battle—in which the Tariff Board is seeking to apply more rigorous standards to defining the efficiency of Australian industry as a means of improving the fundamental strength of manufacturing — is now being replayed on a narrower front in the defence sphere.

Those companies which have regarded a "buy Australia" defence policy as simply another form of protection eliminating the need for them to compete rigorously are going to find themselves in the ironic position of working under a much more vigorous "buy Australian" policy which will also demand higher standards of efficiency and competitive ability.

The defence establishment now gives every indication of being aware of the vital military importance of a strong, vigorous defence industry to back up its fighting forces.

But, as its own standards tighten and its own technological capabilities grow, it is not going to be able to offer much for the half-hearted defence contractor, the inefficient or the slack.

TEMPORARY EMPLOYMENT IN NEW GUINEA

Dear Sir,

I am editor of the P.M.G. quarterly journal "On The Beam."

One of the things I am doing in my retirement is to interview technical staff for employment with the Posts and Telegraphs Dept. of New Guinea.

They have not been able to secure all the personnel they require because local people decline to release many men who desire to go and are qualified to occupy the positions offered.

The following material is self-explanatory and you may be able to include some of it in a forthcoming issue. A good technician would start at $3,696 per annum.

George A. Wiffen,
26a Alma Road,
CAMBERWELL, Vic., 3124.

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The Department also maintains broadcasting facilities for the Department of Information and extension services. These small studio installations generally consist of communication transmitters, used after hours for broadcasting services.

I am a retired P.M.G. Engineer and have been requested to contact suitable technicians retired from the P.M.G. who would be prepared to spend a year or two in the Territories.

Applications from technical personnel from other areas such as the private radio industry or the services would be considered.

Qualifications are completion of an approved course of training in radio telecommunications.

Pay will be at the rate of $3009-$3,696 per annum. Salaries quoted are for single men and include allowances. Married men receive additional allowance of $360 per annum. Income tax is at present about half that payable in Australia.

The period of employment preferred is for a two-year term. Successful applicants would work for 21 months, then be entitled to 3 months leave pay and return air ticket.

I would be pleased to discuss other details including accommodation and local conditions.

(G. A. Wiffen)

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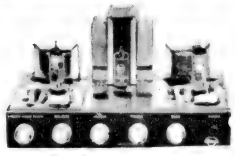

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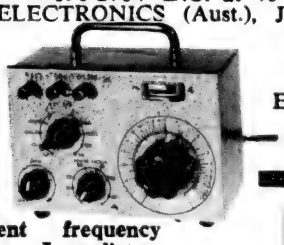

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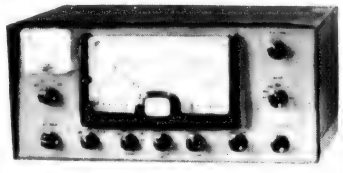

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A TIMER AND SEQUENCER for Slide Projectors

Here is a device which will sequence a slide presentation at a rate predetermined by the narrator, giving him a few seconds warning that a slide change is about to occur. It can operate an automatic projector directly or give an appropriate change signal to a manual operator. A further use of the timer is as a camera pulser for time-lapse movies.

Design by Anthony Leo

The problem which the device is intended to cope with is a fairly familiar one: a devoted colour slide photographer — of which there are many in the community — is invited to show his slides to an interested group of people — a social group, a church group, a hobby class or such like. The slides may be flower or animal studies, scenic gems, a tour, or a coverage of some scientific subject.

The exhibitor very carefully selects his slides, counts them, mentally rehearses what he plans to say about each one and works out that it should take the neat hour, or whatever his allotted time may be.

But alas, his careful planning counts for little at the actual presentation. He may talk at such length about the early slides that an hour sees him only half-way through. He may continue to ramble on, to the embarrassment of the audience, or suddenly discover that he has to forget the rest of the slides or push them through so hurriedly that their value is largely lost.

The reverse can happen, of course, the lecturer being so apprehensive about talking too long, or boring the audience, that he hurries through the presentation, quite unnecessarily and to its detriment.

The slide-enthusiast who owns a timer like the one illustrated above can be saved from this kind of embarrassment. Knowing the time available for presentation, he can select a suitable number of slides and set the timer to sequence them at a suitable rate. He can prepare and rehearse his commentary so that it fits into the allotted time. At the actual screening, the slides will come up at the same rate, automatically disciplining any tendency to become too talkative or too terse in front of an audience.

The device can also be boon to a compere or chairman needing to cope with a lecturer whose abilities or tendencies are unknown. Before proceedings begin, and without embarrassment, he can reach agreement with the lecturer on the time available and the number of slides to be shown. The sequencer can be set for the appropriate presentation rate, thereafter providing a powerful incentive to the lecturer to suit his remarks to the time available.

To be sure, a device which allots an exact predetermined projection time to each slide might be criticised as too "mechanical" and it would be quite redundant, both for the expert lecturer, and the person who is able to pre-record his commentary on tape. In fact, it is not intended for such people but rather for those — in the majority — who cannot rely either on expertise or on pre-recording.

What is more, it is not nearly as impersonal as might appear at first glance. The device switches on a signal light a few seconds before each slide change is due, so that the lecturer can round off his remarks or merge them smoothly into the next commentary segment.

Where a large number of slides have to be put through in a limited time, they can be shown at the rate of about 4 per minute. The other extreme, a very leisurely rate, would be 1 per minute. A good average figure is 3 slides per minute, which means a change every 20 seconds.

It is suggested that the warning light be set to come on 6 seconds before each change so that the "average" sequence would be: change — initial period 14 seconds — warning light for 6 seconds — change.

If interest in a particular slide does warrant more time or less time than the automatically selected value, the lecturer can operate one or other of two switches to delay or hasten the change. This over-ride facility will not change the total screening time unduly, provided the lecturer uses the buttons only when necessary and for both purposes: accelerate as well as delay!

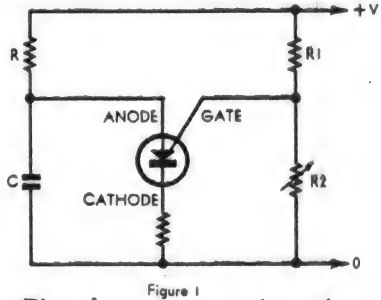


Figure 1

The above diagram shows how a programmable transistor is used in a basic timing circuit. By varying bias applied to the gate electrode the device can be programmed to fire at a particular anode voltage.

When the "Advance" button is pressed the normal timing cycle of the unit is terminated and the device immediately cycles the projector or signals the projectionist. If the Advance button is held down continuously, the projector control circuit will remain closed and this will cause many automatic projectors to cycle continuously.

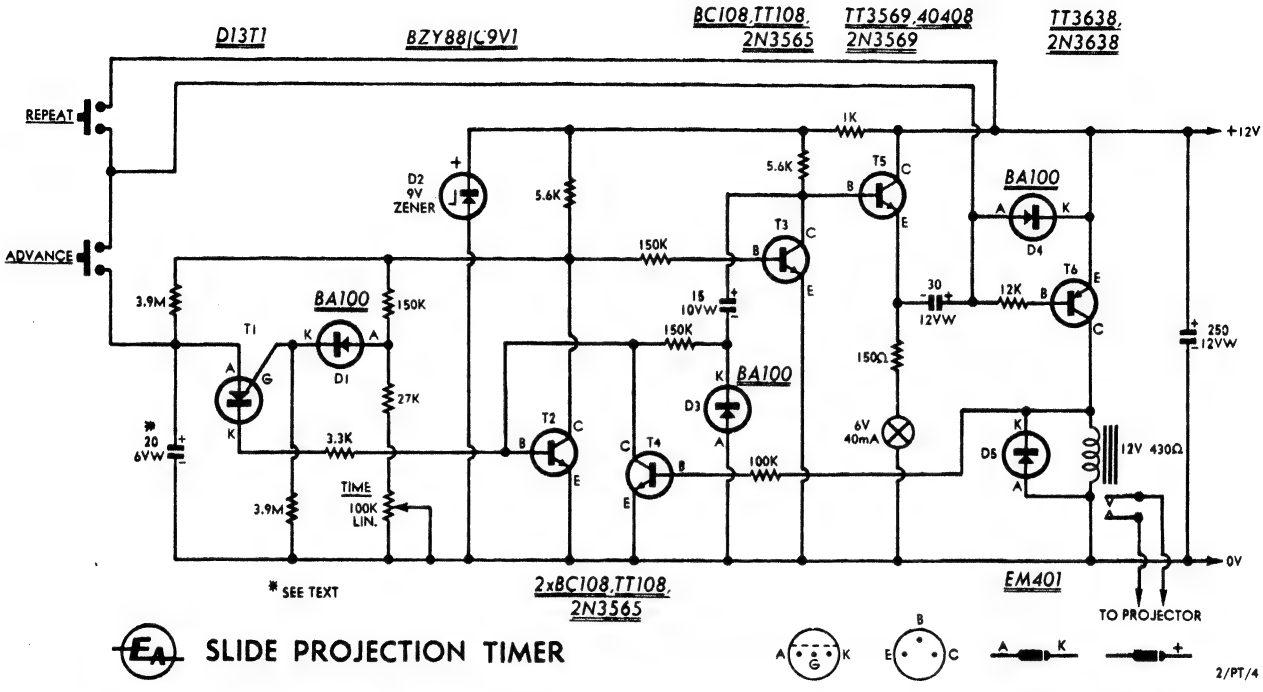
Pressing the delay or "Repeat" button does not interfere with the basic timing cycle but simply inhibits closing of the output control contacts. When the signal light comes up, indicating an impending change, the lecturer needs only to hold the Repeat button down until the light goes out and no impulse will reach the projector or projectionist. If the Repeat button is held down continuously, the lecturer can hold a slide for as long as he desires. The slide will change at the end of the cycle during which the button is released or the change can be initiated immediately by pressing the Advance button.

The basic circuitry can be adapted to meet a variety of situations. In the unit as pictured, the timing control, the over-ride buttons and the signal light are all in the one box which can be placed handy to the lecturer, so that he will be aware of the signal light, even when looking at the screen.

The unit as shown needs to be connected to a power point and a two-wire lead runs away to the projector position, serving the same purpose as a two-wire lead from an ordinary press button. This can close the control circuit to an automatic projector, or to a signal light near a manual projector, or even to a Sonalert (See our November 1968 issue) if the projectionist is in a separate booth.

Obviously enough, various facilities can be deleted or transferred elsewhere, leaving the lecturer with nothing at all, or just a light to warn him of an impending slide change. Different constructors may have their own ideas of how things should be arranged.

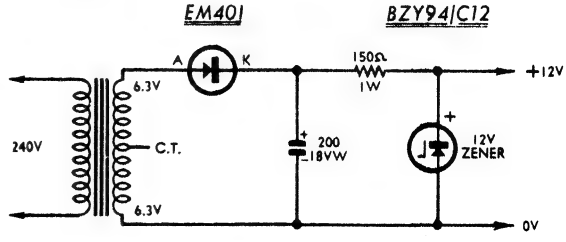
A programmable unijunction transistor, or PUT for short, is the basis of the slide timer circuit. Essentially, the PUT is a four layer NPNP device similar to a normal thyristor or



SLIDE PROJECTION TIMER

The slide timer circuit diagram is shown above. On the diagram a relay is shown as having one pair of closing contacts, required for projector operation, but other contacts may be provided and used for other functions.

Shown at right is a 12V power supply which is suitable for use with either of the timing circuits described here. In some cases the AC supply may be derived from the projector.



silicon controlled rectifier, but having an anode gate rather than a cathode gate. A more detailed description of the device and operating principles is available in the December, 1968, issue under the title "Keeping Up With Semiconductors."

In simple terms, it differs from the thyristor in that it can be programmed to turn on when a specific anode voltage is exceeded, rather than cathode voltage. The anode voltage at which it turns on is determined by the voltage applied to the gate electrode.

Thus a PUT can be used with a capacitor charging network to perform a timing function, as shown in figure 1. When the capacitor charges to a required anode firing voltage the PUT conducts and discharges it through a current limiting resistor in series with the cathode.

Provision to vary the time cycle can be made in two ways. The time constant of the RC combination may be varied, by varying either R or C, or both, or we may alter the anode firing voltage by varying the gate voltage. The latter is much the neater way and can be easily provided by making resistor R2, part of the gate potential divider network, variable.

Essentially, the charging rate of a capacitor is exponential, charging rapidly at first and then tapering off as the voltage increases. So that the time control function might be reasonable, it is desirable to change this to more nearly approximate a linear law.

The simplest approach is to use only the early part of the charging cycle, where the law is more nearly linear. Thus we might arrange for the PUT to breakdown at only one-third of the voltage to which the capacitor would charge if allowed to complete the cycle. We may further improve the linearity if the current which is charging the capacitor is derived from a constant current source. This is approximated if we use a large value of charging resistor R. We could introduce the constant current characteristic of a transistor if the linearity was critical, but such a step is not justified in this case.

If the resistor R is larger than a certain critical value the PUT will come out of the conducting mode when C is discharged. If R is less than the critical value the PUT will latch up, i.e., it will remain in the conducting mode while ever anode voltage is applied.

Thus the basic circuit of figure 1 can be made to have either of two operating modes. Using the larger value of R it becomes a regenerative relaxation oscillator-type timer, delivering pulses at a regular pre-determined rate. Using the smaller value, it becomes a "one shot" timer which has to be manually reset.

From the elementary circuit of figure 1 we have developed two practical circuits. The main one, featuring all the facilities we have discussed is shown on this page. A simpler version, still suitable for projector or other functions, is shown on page 67.

In both circuits the resistor R is

PARTS

1 Metal box (see text).
2 Miniature push buttons.
1 Pilot lamp, 6V 40mA.
1 Speaker socket with plug.
1 Miniature relay, 12V 430 ohms (see text).

TRANSISTORS

1 Programmable unijunction transistor, type D13T1.
3 BC108, TT108, 2N3565 or similar.
1 TT3569, 40408, 2N3569 or similar.
1 TT3638, 2N3638 or similar.

DIODES:

1 BZY98/C9V1.
3 BA100, or similar low power silicon diode.
1 EM401, or similar power diode.

RESISTORS

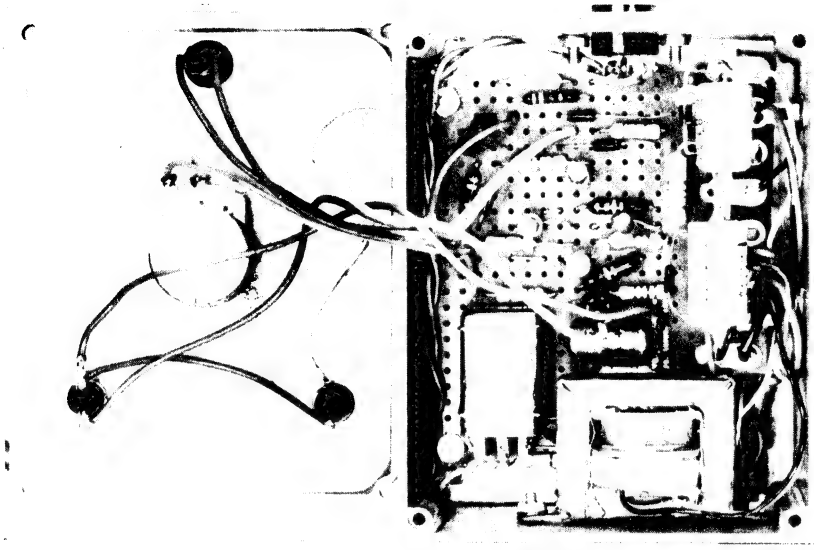
1 100K potentiometer, linear taper.
2 3.9M, 3 x 150K, 1 x 100K, 1 x 27K, 1 x 12K, 2 x 5.6K, 1 x 3.3K, 1 x 1K, 1 x 150 ohms.

CAPACITORS

1 250uF 12VW electrolytic.
1 30uF 12VW electrolytic.
1 20uF 6VW tantalum electrolytic.
1 15uF 10VW tantalum electrolytic.

POWER SUPPLY COMPONENTS

1 Miniature power transformer, 240V to 12.6V at 150mA.
1 BZY94/C12 zener diode.
1 EM401 diode.
1 150 ohm 1 watt resistor.
1 200uF 18VW electrolytic capacitor.
1 Length of mains flex and plug (see text).



An inside view of the timer is shown above together with the lid assembly. The transformer and other power supply components are clearly visible, the latter being mounted on an 8-lug tag strip. Note also the method of fixing the relay to the Veroboard using wire straps.

quite large, 3.9M in one case and 4.7 in the other, while the timing capacitor is 20uF. Because small charging currents are involved it is essential that the capacitor should have very low current leakage. Hence it is necessary to use a tantalum dry-electrolyte capacitor; regular electrolytic capacitors are not suitable.

Typical of all silicon junctions, the voltage between the anode and gate of the PUT will vary with temperature. To make the firing voltage less dependent upon temperature a silicon diode is included in series with the gate electrode.

By exploiting the temperature characteristic of the silicon diode, which is similar to that of the PUT, we effectively compensate for temperature changes. A 3.9M resistor to the negative rail provides the diode with the necessary forward bias.

The complete timing cycle really consists of two smaller timing cycles, operating consecutively. Thus, we use the PUT circuit to provide the major timing cycle of, say, 14 seconds. The completion of this cycle is then used to initiate a minor cycle, say 6 seconds, at the end of which a total of 20 seconds has elapsed, and the slide change function is initiated. The purpose of the minor cycle is to turn on the warning lamp.

The complete timing cycle may be varied over a range from 15 seconds or 4 slides per minute, to 1 slide per minute. It would be possible to increase both the minimum and maximum times available by increasing the value of the 20uF timing capacitor. In addition, the total range over which the timer can be varied could be increased be increasing the value of the 100K potentiometer.

Timing for the minor cycle is provided by means of a monostable multivibrator. This circuit uses two transistors, T2 and T3, with the usual base-to-collector coupling for one transistor, but with an RC time constant network for the other.

In combining these two circuits we must arrange, first, for the major timer to initiate the minor cycle at the end of 14 seconds and, second, for the minor timer to disable the major timer during the 6 second period, so that it does not commence a new 14 second cycle until the end of the minor cycle, i.e., after a total of 20 seconds.

The complete circuit function is as follows. Initally, T2 is cut off with collector at supply potential, and the PUT timer commences. After a set time the PUT discharges the timing capacitor into the base of T2, switching it into saturation, whereupon its collector voltage drops. As a result, T3 is cut off and its collector voltage rises toward supply potential.

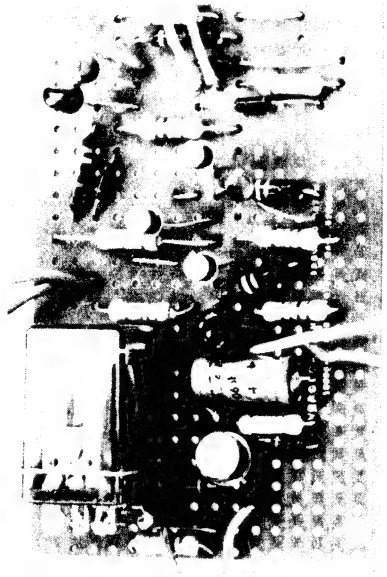
With T3 collector near supply potential, the emitter follower (T5) conducts and lights the 6V lamp. Also the 15uF capacitor, which should also be a tantalum type, commences to charge through a 150K resistor into the base of T2. Thus T2 is held in saturation until the capacitor has charged to a point — after about six seconds — where its charging current will no longer saturate T2.

At this point T2 is turned off and, as a result, T3 is switched on and its collector voltage falls with T5's emitter following it and extinguishing the lamp. While ever the multivibrator is in its timing mode, voltage at T2's collector is very low and the PUT circuit is disabled.

As the T5 emitter falls to the negative supply rail potential, it creates, in conjunction with the associated 30uF capacitor, a differentiated pulse which is applied to the base of T6. This activates the relay in the collector circuit of T6. The 12K resistor in series with the base of T6 ensures that the relay will be held closed for a few seconds; long enough for the projector mechanism to engage and lock up for a complete cycle.

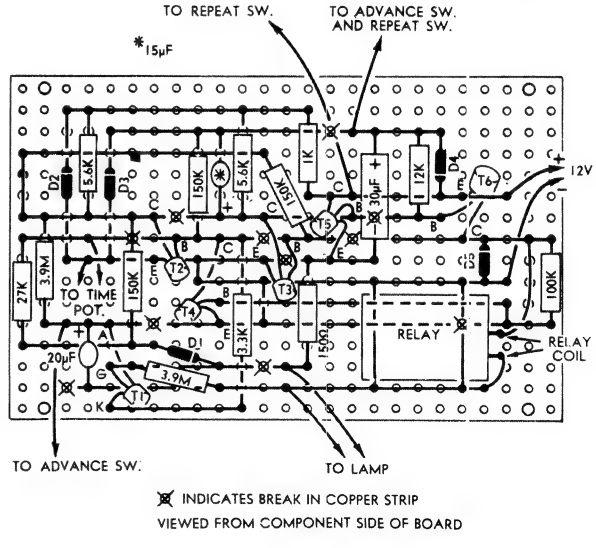
There are several diodes in the circuit, including a power diode across the relay winding to protect its switching transistor against high voltage transients. Depending upon switching speed, quite high voltages can be developed across an inductive load causing irreparable damage to the transistor.

Two other low power diodes are used in conjunction with the 15 and 30uF electrolytic capacitors. The diode connected to the 15uF capacitor ensures reliable multivibrator timing irrespective of the use of the advance button, while the other diode allows the relay to be operated a number

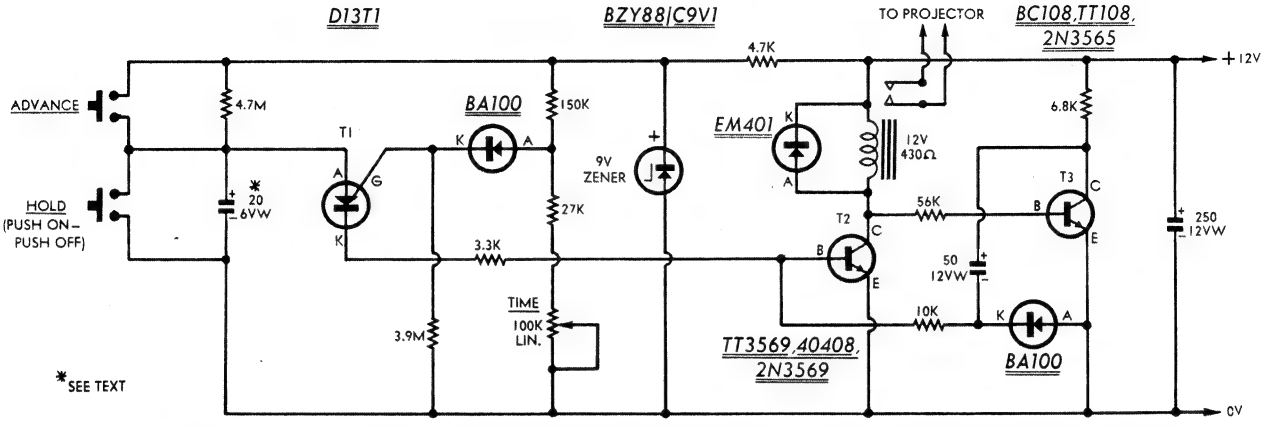


This shot of the Veroboard, removed from the box, clearly shows the positions of most of the components and associated leads.

The wiring diagram for the Veroboard, at right shows the positions and wiring of all the components mounted on the board. Also shown in the diagram are the various take off points for the leads to warning lamp, push buttons and potentiometer.



A SIMPLIFIED GENERAL-PURPOSE TIMING CIRCUIT



Shown above is the circuit diagram of a simplified timer produced by pruning the slide timer circuit. The simplified device is intended for general purpose timing, but will also function as a slide timer.

of times in succession, without having to wait for the 30uF capacitor to recover.

Essentially, the advance button is simply required to energise the relay and engage the changer mechanism. This could be easily done by connecting the resistor at the base of T6 to the negative supply rail via a suitable button. While this method would advance the projector it would not negate the timing cycle already in progress, so that the projector would again be activated when the timing cycle ended. What is required is that the relay should be closed and both timing circuits returned to their start-of-cycle conditions.

This has been arranged by reason of the advance button's position in the circuit and the inclusion of an additional transistor, T4. When the button is closed the 12K resistor at the base of T6 is connected to the PUT anode. Thus current is able to flow through the base-emitter junction of T6, turning it on and energising the relay. The same base current flows through the 12K resistor into the 20uF timing capacitor, charging it almost instantaneously and firing the PUT.

Once the PUT fires the capacitor is completely discharged, thus returning it to the start-of-cycle condition. However, to ensure that T2 is not turned on by the discharge current, so initiating the six-second timing period, a transistor is connected from the base of T2 to the negative rail. This transistor (T4) is switched into saturation at the instant the relay is energised because its base is connected to the collector of T6, via a 100K resistor.

If the timer happens to be in the six-second warning cycle T2 will have already been turned on, but the device will still advance the projector and return both timing circuits to their starting condition. When T4 is switched on, its saturation voltage is less than the base emitter voltage of T2, and T2 is simply switched off.

Thus, the projector can be instantaneously advanced at any part of the timing cycle without upsetting the following cycle or producing any anomalous effects. However, if the advance button is held on, the relay will remain activated and the projector will advance slides in rapid succession until the button is released.

Operation of the repeat button is somewhat simpler, circuit wise, simply inhibiting the switching pulse to T6 base. The button is actually wired from positive rail to the 12K resistor and 30uF capacitor junction. It will be noted that this junction point is common to both buttons, so if they were made remote from the unit only three wires would be required, rather than four, as might be expected.

When using the repeat button it is necessary to hold it closed until the 6-second warning lamp goes out, otherwise T6 will receive a normal pulse from T5 emitter and engage the relay. Once the lamp has gone out the timer will automatically commence another cycle, whether the button remains held down or not.

Although we have only shown one pair of normally open relay contacts, this being all that is required to operate automatic and semi-automatic projectors, we actually used a relay which had a two pole change-over set. The miniature relay, type number 240AFO, was a 12V 430 ohm unit manufactured by Standard Telephones and Cables.

The timer's current requirements will depend in the main, upon the warning lamp and relay, the rest of the circuit requiring only a few milliamps. However, operation of the lamp and relay is intermittent so the average power requirement will be quite modest.

For the prototype, we included a mains power supply using a small Ferguson transformer, type number PF2851. It has a 12.6V centre tapped winding which, when applied to a half wave rectifier, gives about 17V. A zener diode is then used to establish a 12V supply for the timer. Note that a 250uF capacitor across the zener diode is necessary for the correct operation of the unit.

With some later-generation projectors, the necessary low AC voltage could be obtained from the lamp transformer; this may vary between 12 and 24V depending upon the projector type. If 12V RMS is available the supply circuitry may be used, unaltered. But, for 24V RMS the 150 ohm 1 watt resistor should be increased to about 330 ohms with a 4 watt power rating. Also, the rating of the 200uF electrolytic should exceeed 34VW.

Alternatively, if low voltage is not available from the projector and a mains supply at the control point is considered inconvenient, the small power transformer could be mounted in the projector housing. A four-core cable between sequencer and projector, carrying low-voltage AC and the changing mechanism voltage, would obviate the need for a second cable. In some cases the low-voltage supply from the projector and changing mechanism voltage could be common, in which case it may be possible to use only three-core cable, but this will depend upon the particular projector.

The prototype sequencer was wired on a section of Veroboard, with the exception of power supply components which were wired on a tag strip. The miniature relay was attached to the board by two straps, made from 22-guage tinned copper wire, which also served as "jumpers" for the negative rail.

The completed board assembly was housed in a small die-cast metal box

(Continued on Page 141)

PARTS LIST

1 Metal box. (See text).
1 Miniature push button.
1 Miniature push-on push-off switch.
1 Speaker socket with plug.
1 Miniature relay, 12V 430 ohms (See text).

TRANSISTORS

1 Programmable unijunction, transistor, type D13T1.
1 BC108, TT108, 2N3565 or similar.
1 TT3569, 40408, 2N3569 or similar.

DIODES

1 BZY88/C9V1.
2 BA100, or similar low power silicon diode.
1 EM401, or similar power diode.

RESISTORS

1 100K potentiometer, linear taper.
1 4.7M, 1 x 3.9M, 1 x 150K, 1 x 56K, 1 x 27K, 1 x 10K, 1 x 6.8K, 1 x 4.7K, 1 x 3.3K.

CAPACITORS

1 250uF 12VW electrolytic.
1 50uF 12VW electroltic.
1 20uF 6VW tantalum electrolytic.

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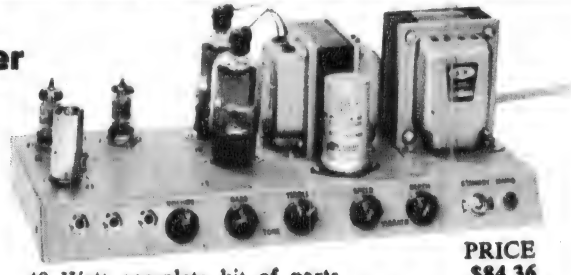

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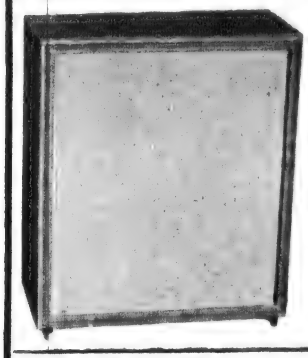

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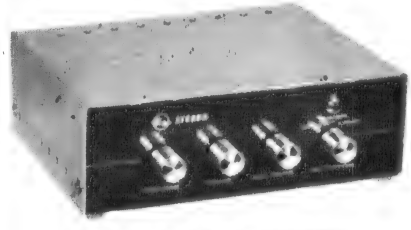

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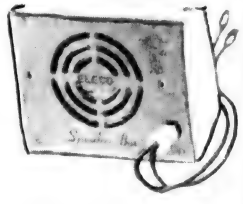

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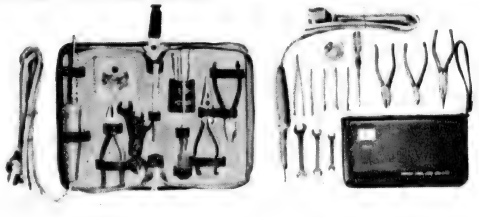

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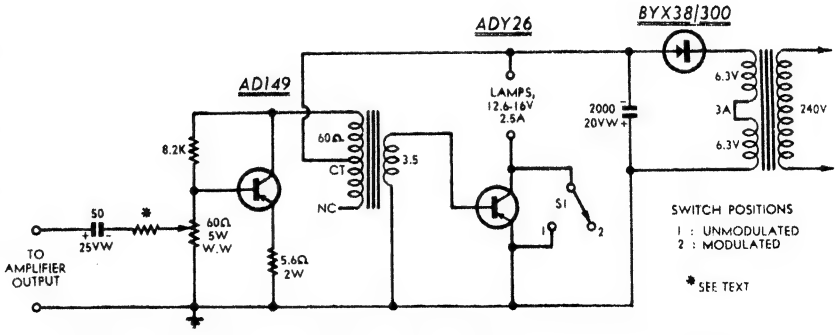
Circuits and devices which we have not actually tested in our laboratory but published for the general interest of beginners and experimenters.

DECORATIVE LIGHTS "PLAY" WITH THE MUSIC

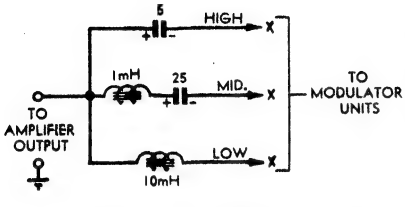
Mr N.T. Paker, 320 Maundrell Terrace, Aspley, Queensland, 4034, submit a circuit for modulating decorative lamps from a musical accompaniment. Intended for the December issue, and the attendant Christmas atmosphere, it unfortunately arrived too late. However, there are other uses, and it will be in plenty of time for next Christmas. (Only 353 days to go!)



Circuit of the light modulation unit. All the components are readily available standard items.

Almost all families who treat themselves to a Christmas tree decorate it with small 12 or 24-volt globes wired in series and operated from the power mains. This is a reasonably effective arrangement, but there is always the nuisance of one bulb failing and putting the whole system out of action until it is located and replaced. There is also the hazard that this simple system may create a dangerous situation if it is damaged or mishandled in any way, or if any attempt is made to use it out of doors.

For these reasons I saw fit to purchase a twin filament transformer



A frequency dividing network to permit lights of different colours to be controlled by the low, middle, or high frequencies.

which, with the two windings in series, supplies 12.6 volts. The existing socket leads were trimmed to about three inches long and connected in parallel across light duty "figure eight" flex connected to the transformer.

Many homes also have recorded Christmas music playing to add to the atmosphere, and added effect is obtained if the Christmas tree lights are "modulated" by the music. I found that this can be done quite simply and, more importantly, quite cheaply. The simplest arrangement I have devised is shown in the circuit diagram.

It consists of a very simple amplification/modulation arrangement, using two power transistors and an assortment of parts, all of which are relatively easy to obtain.

The amount of modulation is governed largely by the setting of the 60-ohm 5W potentiometer, but the level from the amplifier through which the recordings are played is also a factor, since the modulation unit is driven from the speaker voice coil. (A 7W amplifier provides enough drive for the unit.)

The unmarked resistor in series with the input lead is required to prevent undue, and possibly dangerous, loading on the amplifier output when the 60-ohm pot is turned right down. It should be at least somewhat higher than the nominal impedance of the voice coil.

A number of variations on the above circuit are possible. A simple mixing circuit may be used to bring two stereo channels into the unit, or two separate units may be used, with two separate light circuits, to give added effect.

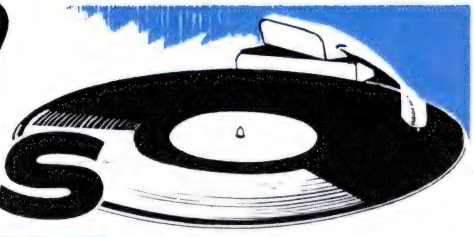
A spectacular effect may be obtained by splitting the sound into three separate frequency ranges (low, middle, and high) and feeding them through separate modulators to separate colour runs. A suitable frequency dividing network is illustrated. While this may be a little adventurous for a Christmas decoration, it has many other uses. For example, imagine the effect of using guitar amplifiers to modulate spot lights of differing colours, according to the frequency of the sound.

The output from each of the divider networks, marked "X," would connect to the input terminal of each amplifier/modulator unit. The control of large lamps, as in a spotlight, would require the development of suitable thyristor control circuits.

Construction of the unit is not critical, requiring only that the transistors used be provided with adequate ventilation and/or heat sinks. A suitable chassis is a metal box measuring approximately 6in x 5in x 4in. The majority of the components may be mounted inside the box but a cut-out is necessary for the power transformer. The AD149 mounts directly on the outside of the case, and this makes an adequate heat sink. The ADY26 must be fitted with a "U" metal heat sink, and this may be fabricated from a strip of blackened aluminium 3in x 1½in.

Additional holes are needed in the box to accommodate two toggle switches and a potentiometer, and also to ventilate the power transformer. Any standard socket may be used for the light circuit connections. A four-pin speaker plug and socket serves the purpose well. ◘

AUDIO TOPICS



ACOUSTIC FEEDBACK — OR WHY P.A. SYSTEMS HOWL!

To the novice audio enthusiast, one of the most puzzling and frustrating situations is to find himself with an amplifier system which is apparently reluctant to amplify — it just howls! Why do amplifiers behave this way?

The situation is a familiar one. The novice audio enthusiast builds an amplifier which performs perfectly, when fed with signal from a radio tuner or gramophone pickup. The sound is quite clean and the amplifier can be turned up to produce adequate sound level for the purpose required.

Thus encouraged, the enthusiast couples up a microphone, turns up the gain and prepares to say a few words by way of test. But, before he can as much as utter a syllable, the loudspeaker emits a whistle or a howl which stops only when the microphone gain control is turned well down toward zero.

A parallel situation occurs fairly frequently with tape recorders. The owner wants to record an item using a microphone, but with the loudspeaker operating so that he can hear the general balance of the sound as it goes on to the tape. But, once again, with any attempt to turn the microphone gain or the loudspeaker level control up far enough to hear things properly, the silence is punctuated by a disturbing howl!

Faced with such a situation, many enthusiasts have assumed that there is something amiss in the amplifier. They have measured voltages, pulled wiring around, perhaps replaced components that they didn't like the look of! Then, having achieved nothing by such measures, they have possibly concluded that the design is a poor one and that they should seek something better — something that doesn't howl when they go to use it!

In fact, the chances are that there was—or is—nothing wrong with the amplifier or with the tape recorder, as the case may be. The enthusiast is up against a basic problem which is very well known indeed to all those involved in sound reinforcement.

It is likely to occur in any situation where sound waves can reach a microphone from the loudspeaker system which it is feeding (through an amplifier, of course).

In an amplifier system, any slight sonic disturbance which reaches the microphone is picked up, amplified and radiated by the loudspeakers. If this **amplified** version of the original disturbance reaches the microphone, a situation arises where an amplifier and loudspeaker is able to energise the microphone which is feeding it — a situation which is defined by the term "acoustic feedback."

If the gain of the amplifier is high enough and/or the microphone is so placed in relation to the loudspeaker system that it can "hear" a substantial proportion of the sound coming from it, the effect of the feedback may be to produce a sustained howl or whistle. Irrespective of the sonic impulse which triggered it, the howl usually occurs at or near a particular frequency where the overall gain of the system is highest, as often as not due to a response peak in the microphone or loudspeaker system or both.

Therefore the problem, as set out in the beginning of this article, is not primarily one of circuit design, or of operating voltages or anything else of a like nature. It is the result of acoustic feedback between a loudspeaker and the microphone feeding it. It may cause a sustained howl, as described, or it may be sufficient only to cause an annoying "ringing" effect during amplified speech.

Using an ordinary inexpensive microphone, and an ordinary loudspeaker in an ordinary room, one should expect acoustic feedback sufficient to cause a sustained howl. In fact, it would be rather surprising if it did not occur!

If the reader should want to test a public address amplifier in a house, or listen to what is being recorded through a microphone, it is virtually essential to operate the loudspeaker and microphone in different rooms and to shut the intervening door(s). Even then, unless the walls, floor and ceiling are acoustically dead, it will still not be possible to turn the gain up too far before feedback again becomes evident.

Even in a larger space, such as in a public hall, acoustic feedback is an ever-present hazard and most people are familiar with amplifier systems which start ringing or howling at the most inopportune moments, when someone helpfully moves the microphone this way or that by a few feet!

Beginners, having come to appreciate the broad cause of the problem, often imagine — or are led to believe — that it is aggravated by the "sensitivity" of various sections of the system; the microphone, the amplifier, or the loudspeaker. The theory here seems to be that if the sensitivity of one, typically the microphone, is reduced and the loss made up in the other sections, the system as a whole will be less prone to the problem.

This is a fallacy. It is the overall gain of the system, including the acoustic link between the speaker and microphone, which determines the point at which it "spills over."

Which is not the same as saying that one system cannot be better than another in regard to this problem. In fact, there can be a very considerable difference and people engaged professionally in sound reinforcement are able to take a number of precautions to minimise the trouble.

One is to use a microphone which is as free as possible from peaks in the frequency response — the kind of peaks around which acoustic feedback will most readily develop into troublesome proportions. With a flat overall response, the reinforcement available over the spectrum generally will tend to be greater before feedback occurs at any one frequency.

Specialists may also select a microphone with directional qualities so that it will pick up sound from the direction of the performer but be less sensitive to sound arriving from the direction of the loudspeakers.

Similarly, professional sound engineers will normally prefer loudspeaker systems which are free from obvious response peaks and which have directional qualities, the sound being radiated towards the audience and away from the microphone position.

In the room of a house, directional properties of microphone and loudspeaker don't help very much because amplified sound, bounced at random from the walls, floor and ceiling, energises the microphone anyway.

However, this brief article is not intended to be one about the installation and operation of sound reinforcement systems. This would demand far more space than is available here. Its purpose has been purely to pose and answer the question as to why amplifiers behave in a particular way.

So, next time you try to operate a microphone and a loudspeaker in the same room, connected to the same amplifier, you will know why the system howls. There's nothing wrong with the circuit or the operating voltages. It's just that it's shouting in its own electronic ear. Isolate one from the other and the trouble should disappear!

NEW *Releases!*

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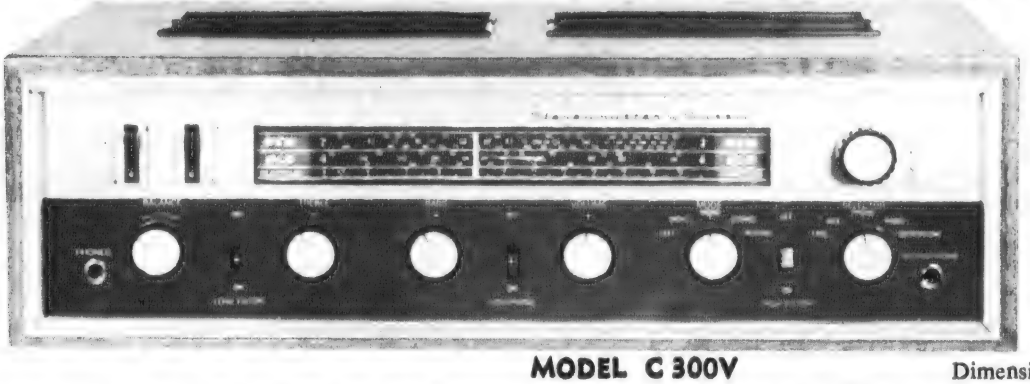
BASED ON THE PLAYMASTER 118 AMPLIFIER



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FREIGHT EXTRA

MODEL C 300V

Dimensions 16½" x 5½" x 11

This amplifier is based on the Playmaster 118 circuit as featured in "Electronics Australia" to which has been added the following features.

- Inbuilt high gain A.M. tuner with a coverage of 530 to 1,600 K.C.
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- High and low filters (scratch and rumble filters).
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- Provision for headphones with headphones-speaker switch.
- Input for microphone with jack on front panel.
- Calibrated dial available for all States.
- EM84 tuning indicator giving accurate tuning with ease.

POWER OUTPUT: 9 watts per channel R.M.S. FREQUENCY RESPONSE: 20 to 20,000 cycles incorporating Ferguson O.P.412 grain oriented output transformers. VALVES USED: 4-6GW8, 12AX7 or 12AU7, 6AN7, 6N8, EM84 and 2 silicon diodes.

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(Cabinet and front panel of valve and transistor amplifiers with tuner are the same)

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Dimensions 16½in x 5½in x 11in.

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107 AMPLIFIER AND TUNER
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107 AMPLIFIER

- Output 5 watts per channel (10 watts). Ferguson output transformers with a response of 30 to 20,000 cycles.
- Valves used: 6AN7, 6N8, 2—12AT7, 2—6BQ5, and 6CA4 rectifier.

SPECIFICATIONS

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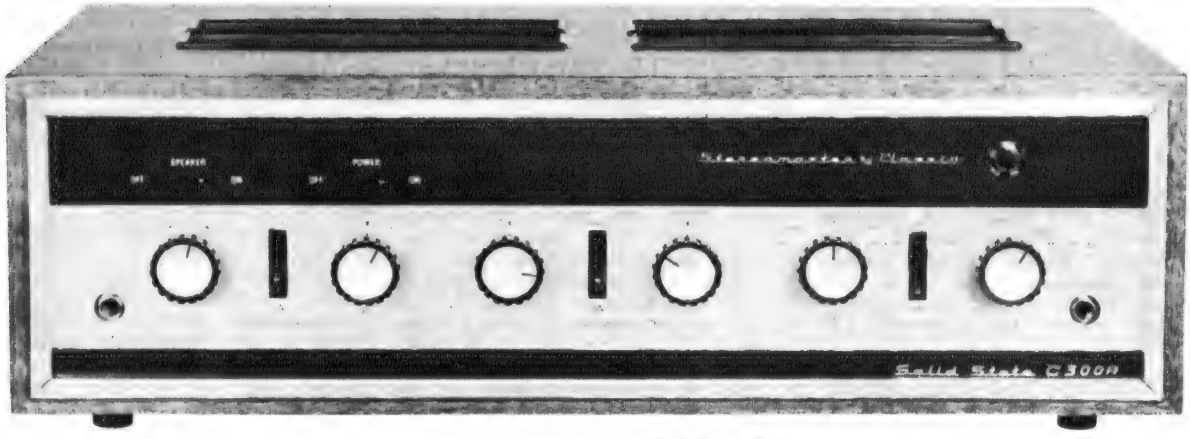

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POWER OUTPUT: 12 watts per channel R.M.S. (24 watts total).
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HARMONIC DISTORTION: Less than 1%.
HUM AND NOISE: Aux. 70dB, Mag. 50dB.
INPUT SENSITIVITY: Mag. 3mv. Aux. 150mv. Tuner 150mv.
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PROVISION FOR TAPE RECORDER. RECORD OR PLAY BACK WITH DIN PLUG CONNECTION.
PROVISION FOR HEADPHONES WITH SPEAKER — HEADPHONE SWITCH.
INPUT FOR MICROPHONE WITH JACK ON FRONT PANEL.
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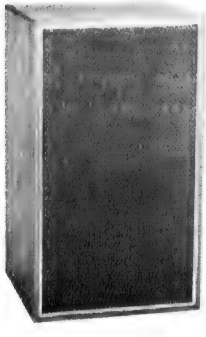

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CLASSIC RADIO

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE 798-7145

Classical reviews

By JULIAN RUSSELL

Berg's Lulu — "magnificent moments"

BERG — Lulu. Evelyn Lear (Lulu); Patricia Johnson (Countess Geschwitz); Barbara Scheller (Gymnast); Loren Driscoll (A Painter); Dietrich Fischer-Dieskau (Dr Schon); Donald Grobe (Alwa) and others. Orchestra of the German Opera, Berlin, conducted by Karl Bohm. DGG Stereo 139 273/4/5.

After having lain more or less neglected since the composer's death in 1935, Alban Berg's unfinished opera "Lulu" has, during the last five years or so, been staged at some of the world's greatest opera houses. I am no stranger to the work. Some 12 years or so ago the former editor of this magazine, the late John Moyle, bought the old Columbia recording of it for me in the U.S.A. (It was not obtainable in Australia.) This was the set in which Ilona Steingruber played the title role, Otto Weiner was the Dr Schon, and Maria Cerny the Countess Geschwitz. The Vienna Symphony Orchestra was conducted by Herbert Hafner. I have played it many times over the years and though my respect for it increased, my affection did not. And though the new DGG is infinitely better in every way, especially in the matter of engineering, and despite the hard work I have put in listening to it, I cannot honestly say that my liking for it has grown. True there are some magnificent moments and Berg's superb sense of the theatre never deserts him. But I don't think a more unsavoury collection of characters have ever been assembled on the operatic stage. They are plain nasty, quite without the tragic majesty of those in say, Strauss' "Elektra." And though "Lulu" will probably last for a while yet in the repertoire of the big opera houses, I cannot imagine it being repeated with the frequency of Berg's other (and to my mind infinitely finer) opera "Wozzeck," which now seems firmly established.

This sordid story was adapted by the composer from two plays by the German playwright Wedekind, "Earth Spirit" and "Pandora's Box." The nymphomaniacal Lulu brings about the deaths of three husbands, and has a lesbian interlude before becoming a prostitute in London, where she is eventually murdered by, of all people, Jack the Ripper. Since the composer did not live to complete the opera (except for sketches which his widow asked should not be worked on by another's hand) the audience is spared the last degrading scene, though most of the music for it is now presented during the performance as a fragment.

The DGG recording was made at a live performance but suffers only slightly from such things as extraneous noises from the public, mechanical noises on the stage, and minor inaccuracies, mostly in the vocal parts. The characters are all delineated with a clarity and contrast missing in the earlier set mentioned above and Bohm conducts the score with a splendidly firm hand. If the voices are sometimes a little too forward to hear all the details of Berg's wonderful scoring, you have increased definition in the vocal parts, especially those magnificently sung by Fischer-Dieskau and Evelyn Lear. The other, minor, characters are all admirably sung and vocally dramatised. While no one interested in avant garde music can afford to miss this fine set — avant garde despite its 30-odd years of age — I myself feel that I shall never be able to approach it with either the love or respect I have for "Wozzeck."

If the set has one real shortcoming it is that the libretto provided is in untranslated German.

★ ★ ★

J. S. BACH—Mass in B Minor. Agnes Giebel (soprano); Janet Baker (contralto); Nicolai Gedda (tenor); Hermann Prey (baritone); Franz Crass (bass). BBC Chorus and the New Philarmonia Orchestra conducted by Otto Klemperer. HMV Stereo SAN195/6/7.

Klemperer first conducted the B Minor Mass 35 years ago but did not feel competent to repeat it till last year. "For me it is the greatest and most unique music ever written" he states in a foreword that accompanies the set. This is not the first time, by any means, that it has been so described, sometimes by people who have never even heard it performed. For those who have, it is an overwhelming experience, whether in a church where an organ usually replaces the orchestra or in concert form with instruments added.

Importantly, to approximate more closely the sound heard in Bach's day, but without any fussy antiquarian substitution, Klemperer uses only 50 singers in the chorus to lighten the wonderful polyphonic writing, and a smallish orchestra. He doesn't use a harpsichord for the continuo but instead seats a cello and bassoon as close as the producer could put them to the Mander positive organ with its lovely sweet tone. The vocal soloists are all first rate, the chorus superb. And stylistically Klemperer seems to have instinctively incorporated the result of the massive research into the music of the period that has taken place during the last 20 years or so. I don't think I am exaggerating when I acclaim this as what will probably be the definitive reading of the Mass for many years to come.

★ ★ ★

MAHLER — Kindertotenlieder. Lieder eines fahrenden Gesellen. Ich bin der Welt abhanden gekommen. Janet Baker (contralto) and the Halle Orchestra conducted by Sir John Barbirolli. HMV Stereo OASD2338.

Despite a few shortcomings, perhaps the most serious of which is the singer's over-loud contribution and the conductor's crushingly affectionate handling of the score, I found much to enjoy in this coupling of two great Mahler cycles. Even at its loudest Miss Baker's remains a beautiful voice to listen to and her dedication to the music ensures many a thrilling sequence in the cycles and some quite marvellous singing in the generous addition, "Ich bin den Welt abhanden gekommen." And I cannot truthfully say that I found Barbirolli's embrace of the music too destructive for my taste. It may be a different reading from that you hear in rival versions by Fischer-Dieskau with both Furtwangler and Kempe conducting the accompanying orchestras, but, to me, it is nevertheless a quite valid one.

Miss Baker and Barbirolli both enjoy, quite justifiably, tremendous popularity and the slight faults mentioned above will, I am sure, not deter their admirers from buying this often lovely disc. After all, Mahler was essentially a romantic composer, and here is a romantic reading — with all stops out.

★ ★ ★

VAUGHAN WILLIAMS — A London Symphony. The Halle Orchestra conducted by Sir John Barbirolli, HMV Stereo OASD2360.

I cannot remember when I have not known — and loved — the London Symphony of Vaughan Williams, though it is many years since I last heard it. So my pleasure was increased by listening to it again under the inspired baton of Barbirolli. He and the composer were great friends and the latter had a very great admiration for the Halle Orchestra, who play it again here with all the freshness of a new work. Vaughan Williams always disclaimed the fact the "London" was program music, just as he denied that his great Fifth Symphony was influenced by the war that had preceded its composition. And in both cases he must be believed, though the tendency to look for programmatic passages will always be strong.

He uses two well-known London themes — the Westminster chimes and the lavender street cry. But these are only incidental in a work that does not describe the physical features of the city but rather its atmosphere and the nature of its inhabitants. And in this its creator succeeded brilliantly. If you are a stranger to the work you will first be struck by the composer's modal style. Next you will become aware of the firm structure of a work wrought

by one of the last of the great dialectical symphonists. The two combine to offer a work which I have never tired of during most of my adult life and which I have never heard played with more affection and understanding than in Barbirolli's beautiful performance. The engineering is great, too.

★ ★ ★

SCHUMANN—Piano Concerto in A Minor, Op. 54. Artur Rubinstein and the Chicago Symphony Orchestra conducted by Carlo Maria Giulini.
Novelletten Nos. 1 and 2 from Op. 21. Artur Rubinstein.

Nowadays it is not often that one finds a new recording by Artur Rubinstein disappointing, but I must state at the outset that the concerto has this great pianist at far from his best. His playing throughout lacks the vitality one has come to expect in everything he records. Here he sounds no better than pedestrian, even listless, in one of the world's great works for piano and orchestra. Moreover the sound is woolly and ill-defined.

However the disc is not without its compensations for in the Novelletten you have Rubinstein at his finest. In these he captures the carefully measured impetuosity that characterises the best Schumann playing and his technique, even at his advanced age, remains as clean and effortless as it was 30 years ago. Some buyers might think it an extravagance to pay for a whole disc just to enjoy the fills. And I would be inclined to agree with them. But that didn't inhibit me from enjoying the Novelletten as a very exciting experience indeed.

★ ★ ★

BAX—Symphony No. 6. The New Philharmonia Orchestra conducted by Norman del Mar. World Record Club S/4420.

This is another youthful memory that I have renewed with unexpected pleasure, since there is always a danger that something admired so long ago might not live up to present tastes. Unlike houses you revisit after an absence of many, many years it did not seem to diminish in stature. Although it cannot, in my opinion, rank with the Third Symphony, that fine rhetorical work, it nevertheless has provided me during the last few weeks with much enjoyable listening. It was composed in 1934 and like much more — even most — of Bax's other music is landscape inspired, this time by the rugged north-west coast of Scotland. And, as usual, it is picturesquely evocative.

Under del Mar the New Philharmonia plays it with all their customary skill and understanding. But the recording engineer was not quite so sensitive to the composer's idiom. Bax was essentially a romantic composer who, despite the richness — and solidity — of his orchestration, was closely linked with the French Impressionist school. Consequently more diffused, or perhaps less sharply defined, detail would have made it sound nearer to what the composer had in mind. His scoring does not respond sympathetically to spotlighting of woodwind passages which, instead of merging into the score, have in this recording a tendency to stand out. This could have been done without any sacrifice of the glittering points of light that line the edges of Bax's orchestration.

Moreover, the fine Philharmonia strings pay too much attention to the linear aspect of what they are playing rather than to a blended whole. Despite these minor shortcomings — and I stress the fact they are indeed minor — the new performance is more than welcome and I hope that its production may presage the recording of more of Bax's lovely compositions. They will, I am afraid, have little appeal to the younger generation, but I think the makers could rely on a grateful welcome from the older one.

★ ★ ★

IVES—Symphony No. 1.
Three Places in New England. The Philadelphia Orchestra conducted by Eugene Ormandy. CBS Stereo SBR235267.

The main interest in this disc will be found in the New England pieces rather than the symphony. The latter was a student work, of undoubted talent but essentially conventional. Its dominating influence is that of Dvorak, perhaps because of that composer's visit to America and the resultant "New World" Symphony and other works inspired by the American scene, all of which must have been known to Ives. Anyway there is little to be heard in the symphony that hints at the anarchic works of Ives that were to follow.

In case you have not heard any of the later works, Ives, isolated from the main stream of European music, devised on his own a method of composition that was not heard in Europe till the Second Viennese School got busy in the first decade of this century. There are long stretches of atonalism, polytonality is frequent — Ives' father used to make him play a piece in one key while he played it in another — and even some hints of serialism. Thus in the first of the New England pieces, "The St. Gaudens' in Boston Common" you have well-known American Civil War tunes thickly overlaid with vehement polytonal exercises.

In "Putnam's Camp" Ives combines several marches played simultaneously in different keys to make a grand row, if one without any great distinction. I liked best "Hausatonic at Stockbridge," a much more delicate and sensitive piece than the others, in which a beautifully wrought, quiet accompaniment sets off a rather ordinary American-sounding tune. You may well think the disc worth having just for these three pieces though none has the same interest as the daring later symphonies.

★ ★ ★

HAYDN—The Creation, Judith Raskin (soprano); Alexander Young (tenor); John Reardon (baritone); the Camerata Singers and the New York Philharmonic Orchestra conducted by Leonard Bernstein. CBS Stereo 2SBR220028 (two discs).

Not surprisingly, Bernstein goes all out for the drama of this lovely oratorio of Haydn with its innocent depiction of nature reminiscent of the "naif" school of painting. In fact his approach might well be described as operatic rather than oratorian. This, however, is no fault, since everything is sent along with Bernstein's usual invigorating drive while, at the same time, providing points of repose for some quite beautiful and sensitive quiet playing. Moreover the sound, recorded in the CBS "360" system, exposes with limpid clarity the wonderful ingenuity of Haydn's scoring.

Alexander Young is no cooing oratorio tenor. His voice is robust enough to do justice to many a Wagnerian role, yet sufficiently agile for Haydn's most florid passages and melismata. John Reardon, too, his voice always smoothly controlled yet of impressive ringing quality, is well enough equipped, both vocally and technically, to match Young's considerable contribution. Judith Raskin is by now probably well enough known to most listeners to prepare them for her beautiful performance, accurate without strain and always alluring in quality.

Unfortunately, no copy of the text in either German or English accompanies this otherwise enjoyable set, and this might deprive many unfamiliar with the masterpiece from much pleasure in following Haydn's telling excursions into musical realism. And I don't think that even a profound knowledge of the first book of Genesis will provide any help either.

★ ★ ★

BARTOK—Sonata for Two Pianos and Percussion. John Ogdon and Brenda Lucas (pianos) with Tristan Fry and James Holland (percussion).

Piano Concerto No. 3. John Ogdon and the New Philharmonia conducted by Sir Malcolm Sargent. HMV Stereo OASD2347.

The Sonata for Two Pianos and Percussion is one of the composer's more difficult but ultimately rewarding works. It is played here by a husband and wife team, which is not without significance since Bartok wrote it for his wife — as he did the Third Piano Concerto, too, for that matter. Let me say at the outset that, despite her husband's formidable—and well-earned—reputation, Brenda Lucas is by no means overshadowed in this performance. It is a collaboration of equals, pursued with impressive unanimity of purpose and parity of techniques. Both these features are of the utmost importance, since Bartok, with a keen knowledge of the instruments' capabilities, explored new sonorities which exploit pretty well everything of which the instruments are capable.

Every note is in place, the touch of both players has just the right percussive quality without the brittleness it might bring to a composer such as Prokofieff. And, importantly, the two percussionists, for whom no praise would be too high, are balanced to perfection against the pianos. And, again importantly, the engineering has overcome the problems of recording such a combination, without a single hint of distortion.

The Third Piano Concerto is much easier to appreciate at first and, perhaps for some people, even subsequent hearings. Indeed, it has during the past few years become a standard concerto heard regularly in concert programs in Australia and all over the world.

Though it has been recorded several times, my favourites have always been the two Katchen performances, the first with Ansermet and the Swiss Romande, the engineering of which nowadays sounds pretty primitive (1954), and his much more recent disc (1966) with Kertesz and the London Symphony.

Katchen's approach to the first movement is much more romantic than Ogdon's, though the latter's use of delicate pianissimos suggests an almost crypto-romantic attitude. In the second movement, with its beautiful, soft chorale-like opening theme, and later some of Bartok's typical "night music", my preference is all for Katchen. Katchen's Finale is brought off with a little more swagger than Ogdon's, whose reading suggests to me the way Bartok might have played it himself. I base this opinion on the fact that I still have the record "Bartok Plays Bartok" put out many, many years ago by the W. and G. Company and now something of a curio.

★ ★ ★

POULENC. Song cycles: Chansons Gaillardes; Tel Jour, Tel Nuit; Avant Le Cinema; Hymne; Main dominee par le Coeur; La Souris; Nuage; Le Portrait; Derniere Poeme; Air Romantique; Rosemonde; Paul et Virginie; . . . Mais Mourir. Gerard Souzay (baritone) and Dalton Baldwin (piano). RCA Stereo LSC 3018.

During his recent Australian tour, Souzay often included a Poulenc bracket in his vocal recitals. For those who enjoyed his elegant singing of these often charming pieces, most of them very brief, this complete disc devoted to Poulenc's songs should be most attractive. A great many of them are very brief, some consisting of only a few bars. They range through many moods, some have a most fluid vocal line, others are mere patter songs.

Though in many cases deceptively simple, all are highly sophisticated. Souzay sings every one as beautifully as you might have hoped. And his co-artist, Dalton Baldwin, again demonstrates that he is today one of the world's finest accompanists. But again, alas, no English translation of the text goes with the disc.

★ ★ ★

BEETHOVEN—Piano Sonata No. 29 in B Flat, Op. 106 (Hammerklavier). Vladimir Ashkenazy. Decca Stereo SXL6335.

As a rule, I write with the greatest enthusiasm of every disc issued by Ashkenazy. But I found this new one a trifle disappointing. There is nothing wanting in his technique, although it is extended to its full limits, as is everybody's who tackles the challenge of this gigantic work. His tempos are impeccable. What, to my mind, is missing is the overall grandeur of the music, grandeur that is unmistakably present in the recordings of it by at least three other pianists, Schnabel, Kempff, and Solomon. Indeed the last named offers my favourite performance of it. All this adds up to a smaller than life-size reading by Ashkenazy. And in arriving at this opinion I was in no way prejudiced by Ashenazy's beautiful Chopin playing. ■

DOCUMENTARY RECORDS

Reviewed by Glen Menzies

LONDON'S LAST TRAMS. Narrated by John Holmes with actuality recordings. Argo Mono DA78.

This is of necessity a documentary of limited appeal but Australia is not without its own tramway enthusiasts and I know of at least two societies in Sydney concerned with the preservation of old trams and doubtless there are others elsewhere.

For the people of Sydney, trams are becoming a distant memory revived only when they journey as far afield as Melbourne or Brisbane. Old ladies riding in Sydney's hot, crowded buses are often heard to say, "They should never have got rid of the trams."

Because of its sheer size the London tramway system took some beating. In its heyday it had a maximum of 345 route miles served by 2,600 trams. The authorities began scrapping them before the war and towards the end of 1950 they began an eight-stage program to get rid of the rest. That is what this documentary is all about. It is based on the recordings made by a group of enthusiasts from September, 1950, until the very last tram ride on July 5, 1952. The changeover from trams to buses was usually made on Saturday night and in some districts official last trams were run and people made a night of it, civic dignitaries and local organisations contributing to the ceremonies. On this album we not only hear the once familiar sound of trams rattling along the various routes but also the voices of local mayors wishing them a fond farewell with a noisy but good-natured crowd in attendance.

One cannot help but admire the tenacity of the four enthusiasts who covered these events using recording equipment which was far from portable. The quality of the sound is always good and the on-the-spot atmosphere sounds lively and authentic. Careful editing and choice of material plus crisp narration help in pointing up the historical interest and authenticity of this souvenir of the end of London's tramways.

★ ★ ★

THE BRAINS TRUST. Professor C. E. M. Joad, Sir Julian Huxley, Cdr A. B. Campbell, Sir Malcolm Sargent, Cdr R. T. Gould, Philip Guedella, Sir Harold Nicolson, Lady Barbara Ward Jackson. Argo Mono DA38. Recorded with the co-operation of B.B.C. Radio Enterprises.

This famous B.B.C. program was first broadcast in the dark days of the German air raids. The program planners at the B.B.C. devised the show with all those thousands of listeners in mind who wanted to hear something more substantial than dance music and variety shows. The Brains Trust was to be serious in intention, light in character.

The first program was heard on January 1, 1941, in the Forces Program under the title "Any Questions?" With occasional rests it was heard throughout the 1940s and became something of an institution. Scheduled for six weeks it ran for 18 months and after being rested for two months it came back with an extended time of 45 minutes with a peak listening audience in excess of 12 million. The audience overseas must have been a huge one too, for wherever B.B.C. transcriptions or short wave broadcasts were heard, so also was the Brains Trust.

Hearing the voices again after such a long lapse of time, one is immediatley struck by the leisurely pace. If there was a stop watch in the studio, I'm sure that the panel steadfastly ignored it. Perhaps this air of leisureliness is even more marked by the fact that the members of the panel did not shout each other down nor did they try to create a spurious air of controversy where it did not exist.

Joad's popularity as a result of his Brains Trust broadcasts was quite fantastic and he became a national figure. What a lively mind the man had with just the right touch of iconoclastic wit! His pet phrase, "It all depends what you mean," soon became a catchphrase. His insistence on clarity of meaning must have helped to counter a lot of woolly thinking. The down-to-earth character of Cdr. Campbell with his supply of anecdotes proved a good foil to the agile wit of Joad and the sometimes awesome profundity of Professor Julian Huxley. In those war-torn years of the early 1940s these broadcasts from a studio "Somewhere in England" must have seemed like a haven of sanity in a mad world.

There is something very refreshing about the sound of a group of erudite, articulate people taking part in a civilised discourse drawing on the knowledge of a lifetime. There is a vast difference between this and the gushing forth of a stream of mere information.

The producer of this record, Douglas Cleverdon, must have been faced with an immense task in deciding what to use from all the material available. What he did choose makes very good listening and will bear quite a deal of repetition.

I particularly enjoyed Sir Malcolm Sargent's remarks, and the following discussion with Joad, on the art of the conductor. Also Joad and Campbell on knowledge and intelligence, and the cutting wit of Philip Guedella on the cult of modern biography and Joad with Huxley looking at Eastern and

(Continued on page 125)

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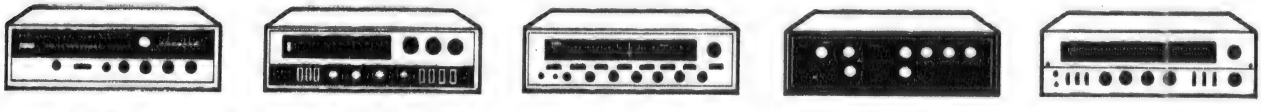

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VARIETY FARE

Reviews by: Neville Williams Harry Tyrer
T. Forbes Cameron

Devotional

SONGS OF SALVATION. The Scottish Festival of Male Voice Praise, conducted by James McRoberts. Stereo, Word (Sacred Productions Australia) WST-9030-LP.

Interest: Excellent male choir.
Performance: First rate.
Stereo: Normal.
Quality: Excellent.

Founded in Glasgow in 1934 by James McRoberts, the Male Voice Praise Choir Movement has become worldwide in its outreach and influence. In the British Isles alone, there are about 100 associated choirs, drawn from non-professional singers and dedicated primarily to singing the praises of God. The group presented on this album is drawn from the Glasgow and West Scotland area Choirs.

Singing for the most part unaccompanied, the harmony and phrasing is virtually above criticism. At 27 minutes total, the playing time is not generous but there are nevertheless twelve tracks, each the subject of an informative jacket note: O Brothers Lift Your Voices — Tell The World About It — Love, Wonderful Love — O Lamb Of God, I Come — Christ For Me — Come Over Into Canaan — Glory, Hallelujah — Hushed Was The Evening Hymn — How Lovely Is Thy Dwelling Place, O Lord of Hosts To Me — When I Survey The Wondrous Cross — I Would Have The Saviour With Me — Brightly Beams Our Banner.

Well worth a hearing for those interested in male choirs. (W.N.W.)

★ ★ ★

MUSIC FOR MATINS AND EVENSONG. Choir of Wells Cathedral conducted by Denis Pouncey, Organist and Master of the Choristers. Assistant Organist Anthony Crossland. Rev. R. J. A. Askew, Priest Vicar. Stereo, World Record Club WRC S/2166.

Interest: See title.
Performance: Excellent.
Quality: Good.
Stereo: Normal.

An H.M.V. recording, released in Australia exclusively by the World Record Club, this album will be limited in its appeal to those familiar with — or interested in—the Anglican cathedral form of worship. However, I gather that previous releases along these lines have been well received.

Both sides of the recording are continuous but, for guidance, the contents are set out as follows. Side 1 (Matins): Preces — Venite — Psalm 118 (vv 129-144) — Te Deum in G-Major (Vaughan Williams) — Jubilate — Creed and Responses — O Most Merciful.

Side 2 (Evensong): Preces — Be Thou My Guardian — Psalms 149 and 150 — Magnificat and Nunc Dimittis in E-Minor — Creed and Responses — Gloria In Excelsis Deo.

The word "Performance" which appears at the head of the review is hardly an appropriate one for a recording such as this but, accepting the reservation, it fully warrants the description "excellent." This one would expect from a cathedral with such a history of worship, extending back to 1140 and earlier. The jacket notes give information on the cathedral, its liturgical forms and on the music itself. (W.N.W.)

WHISPERING HOPE. Jo Stafford, Gordon Macrae with orchestra conducted by Paul Weston. Stereo, Capitol ST-1696. Also in Mono.

Interest: Gospel favourites.
Performance: Pleasant, relaxed.
Quality: Good.
Stereo: Normal.

The hymns and Gospel songs on this album have been sung and played so many times over the past few years that, presented by anyone less capable than Jo Stafford and Gordon Macrae, they must surely have sounded threadbare and even dreary.

In fact, with a flowing, gently rhythmic accompaniment by the Paul Weston orchestra, the two set a quietly devotional atmosphere with "Whispering Hope" and this is maintained right through the album. To Gospel-oriented teenagers it will probably be written off as altogether too "square" but I imagine that their parents and grandparents will be perfectly happy to let it play right through, track after track.

Whispering Hope—Abide With Me — In The Garden — Beyond The Sunset — Beautiful Isle of Somewhere — It Is No Secret — I Found A Friend — The Old Rugged Cross — Rock Of Ages — Star Of Hope — Now The Day Is Over — A Perfect Day.

Conservative — but very pleasant to round off the evening. (W.N.W.)

Instrumental, Vocal & Humour

OVERTURE. The London Philharmonic Orchestra conducted by Stanley Black. Decca Phase 4 (E.M.I.) Stereo PFS 4144.

Interest: Famous overtures.
Performance: Bravo!
Quality: Excellent.
Stereo: Well spread.

Stanley Black returns to the light classics field again with this collection of popular overtures: The Bartered Bride — Orpheus in the Underworld — Light Cavalry — William Tell. These are all light-hearted pieces (barring a few darker passages in "William Tell") and are treated accordingly. The result is a sparkling performance, lively and gay, but never overdone. Recorded in Decca's lifelike Phase 4 sound, the performance is a pleasure to listen to. However, I must complain about the short measure provided. Side 1 plays for only 17 minutes, and sided 2 falls just short of 20 minutes. Hardly good value for a disc selling for $5.75, particularly in view of the numerous other recordings of these popular pieces. (H.A.T.)

★ ★ ★

RAVEL'S BOLERO and other Good Time Classic Sound Spectaculars. The Pittsburg Symphony Orchestra conducted by William Steinberg. Capitol (E.M.I.) Stereo SP 8652.

Interest: See title.
Performance: Brilliant in parts.
Quality: Very good.
Stereo; Normal.

Besides the "Bolero" of Ravel, the other "good time classics" included in this selection are Moussorgsky's "Night on Bald Mountain" — Kamarinskaya (Glinka) — Pavane for a Dead Princess (Ravel — Polovtsian Dances (Borodin).

As music, Ravel's "Bolero" can be excessively boring, but as a superb example of skilful orchestration it has always exercised a fascination which shows no signs of diminishing with the passage of years since Ravel presented it to the world with the description "orchestral tissue without music." It follows that the onus is completely on the orchestra to make the work acceptable. This performance is good, but I must say I have heard better performances which hold the attention

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more. The same might be said of the Ravel "Pavane for a Dead Princess." The Moussorgsky "Night on Bald Mountain" and Glinka's "Kamarinskaya" are very well performed, but it is in the "Polovtsian Dances" of Borodin that the orchestra really excels. This is the best (by which I mean the most stirring) performance of this work I have heard since the old Stowkowski version of about 20 years ago.

The throbbing primitive passions of the music are fully realised, showing none of the rather tame inclinations I have complained about in some recent performances. I find it hard to imagine a better version coming along for some time, so this performance goes to the top of the list as far as I am concerned. (H.A.T.)

★ ★ ★

BOLERO. Andre Kostelanetz and orchestra. Mono, Harmony (CBS) HA-051.

Interest: Classical Excerpts, etc.
Performance: Varies.
Quality: Normal mono.

Ravel's "Bolero" from which the album takes its name, is the first track and is played by the Robin Hood Dell Orchestra of Philadelphia. It would be hard to rate it as anything more than routine.

The remainder of the album comes from Andre Kostelanetz' own orchestra, which certainly sounds crisper, both musically and technically, the other item on side 1 being Rossini's "William Tell" Overture.

Overall, side 2 is much more rewarding, with five tracks giving 30 minutes of playing time between them: Wedding Dance from "William Tell" — Bacchanale from "Samson and Delilah" (Saint-Saens) — Dance of the Sylphs from "Damnation of Faust" (Berlioz) — Waltzes from "Faust" (Gounod) — Capriccio Espagnol Op. 34 (Rimsky-Korsakov).

The sound on all these tracks is full and clean but I'm afraid that I've listened to too much stereo, not to miss the extra dimension that it offers. Still, for those to whom the tracks appeal, this economy re-release may be considered well worth its modest purchase price. (W.N.W.)

★ ★ ★

REVERIE: The Royal Liverpool Philharmonic Orchestra conducted by Charles Groves. Columbia Studio 2 Stereo SCXO 7864.

Interest: Light classics.
Performance: Pleasing.
Quality: Good sound, some tape noise.
Stereo: Very well spread.

The selection here is somewhat of a mixed bag, comprising as it does some sublimely beautiful tunes as well as some which are shallow and ineffective. The titles are: Nocturne No. 10 in A flat (Chopin) — Meditation from Thais (Massenet) — Nocturne from "Midsummer Night's Dream" (Mendelssohn) — Nocturne from String Quartet No. 2 (Borodin) — Adagio in G minor -(Albinoni Giazotto) — Dance of the Blessed Spirits from "Orfeo" (Gluck) — Pavane (Faure) — Judex from "Mors et Vita" (Gounod).

The Albinoni "Adagio," Gluck's "Blessed Spirits" and the Faure "Pavane" are all wonderful melodies worthy of inclusion in any selection of light classics. The Chopin and Mendelssohn "Nocturnes" are pleasant listening at any time. However, I personally find the Massenet "Meditation" a tiresomely trite piece, and I cannot take to the Borodin "Nocturne" as an orchestral piece (it was originally written for string quartet). The disc ends on a weak note with "Judex" by Gounod, an intermezzo from the now forgotten cantanta "Mors et Vita." If this piece is a fair example of the work, I am not surprised it has been forgotten. Why anybody should want to resurrect this banal tune is beyond my comprehension.

The orchestra generally plays in very pleasing style, and the various pieces provide solo opportunities for displays of virtuosity by the first desk performers. However, the handling of these pieces by Charles Groves is not beyond criticism — I should have liked a lighter touch and finer shading for the Gluck and Faure items, for example — but on the whole this is a very enjoyable performance which should give a lot of pleasure to those who favour lighter fare of this type. (H.A.T.)

★ ★ ★

THE PIRATES OF PENZANCE. Soloists and chorus of the D'Oyly Carte Opera Company, with the Royal Philharmonic Orchestra conducted by Isidore Godfrey. Recorded under the auspices of Bridget D'Oyly Carte. Decca (E.M.I.) Stereo SKL4925-6 (two record set).

Interest: Gilbert and Sullivan.
Performance: One of the best.
Quality: Clear, clean sound.
Stereo: Good spread.

As far as I could ascertain, the only other complete recording of "Pirates" current available in Sydney is the Sargent-Glyndebourne version now on the World Record Club label. The last recording made by D'Oyly Carte, in 1958, has since been deleted. This version features an almost entirely new generation of G & S soloists, most of whom I have not heard before. I must say that on the whole they seem to me to be rather better than the soloists of the earlier set, and probably just slightly ahead of the soloists in the Sargent performance. Particulary good are Valerie Masterson as Mabel, who has no trouble at all with the taxing coloratura passages of her role; and Christene Palmer as Ruth, the pirates' maid-of-all-work.

The other soloists are: John Reed as Major-General Stanley; Donald Adams as the Pirate King; George Cook as Samuel; Philip Potter as Frederic; Jean Allister as Edith; Pauline Wales as Kate; Susan Maisey as Isabel; Owen Brannigan as Sergeant of Police (a part which he also played in the Glyndebourne performance).

I prefer the chorus of the Glyndebourne group for the clarity of their diction, as in this performance some of the choral passages sound slightly muffled. In other respects, the two performances are about equal. However, the sound quality of the new recording is definitely superior. The Sargent performance is a bit long in the tooth now as recordings go, and was recorded at rather low level. This new version has the brilliance of the best modern recordings, and wide dynamic range. (H.A.T.)

★ ★ ★

WERNER MULLER PLAYS LEROY ANDERSON. World Record Club Stereo S/4431.

Interest: For Ballroom Dancing.
Performance: Strict tempo.
Quality: Excellent.
Stereo: Good spread.

If, like me, your are an admirer of Leroy Anderson's music, and find pleasure in just listening to it, you may be disappointed with these renderings by Werner Muller. They are presented here as music for ballroom dancing, and therefore played in the strict tempo style. Any music played this way tends to lose some of its interest for the listener, but particularly so the sparkling trifles of this composer. To my mind, it does not lend itself at all easily to this kind of musical straitjacketting. On the other hand, if you want a good collection of tunes for ballroom dancing, there is a good variety of styles included here, played by one of today's best-known ballroom orchestras.

The selection comprises: Fiddle Faddle (Quick Foxtrot) — Blue Tango (Tango) — Forgotten Dreams (Inter-

mezzo) — A Trumpeter's Lullaby (Cha Cha) — Sleigh Ride (Quick Foxtrot) — Belle of the Ball (Waltz) — The Typewriter (Quick Foxtrot) — The Syncopated Clock (Slowfox) — Sarabande (Sarabande) — Jazz Pizzicato (Medium) — Bugler's Holiday (Quick Foxtrot) — Serenata (Beguine). Originally relased as a Decca Phase 4 recording, the disc has excellent sound quality and stereo spread. (H.A.T.)

★ ★ ★

PER ARDUA AD ASTRA. A musical tribute for the 50th Anniversary of the Royal Air Force. The Central Band of the R.A.F. with choir, conducted by Wing-Commander J. L. Wallace. Solos by John Lawrenson, baritone. His Master's Voice (E.M.I.) Stereo OCSD 3647.

Interest: See above.
Performance: Fine standard.
Quality: Very good.
Stereo: Normal spread.

Issued to commemorate the fiftieth anniversary of the founding of the Royal Air Force, this disc features some fine playing by the Central Band of the R.A.F. The music consists of those items specially written for the R.A.F., or those which it has appropriated to itself during the 50 years of its existence — marches, ballads, film music and fanfares: Salute to the R.A.F. (Fanfare) — Cavalry of the Clouds — The Ballad of Sulamain — Those Magnificent Men in Their Flying Machines — Bless 'em All — Out of the Blue — Lords of the Air — March of the R.A.F. Association — Fanfare of the R.A.F. Call — Battle of Britain March — Spitfire Prelude and Fugue — The Dam Busters — Bring Back My Bomber—633 Squadron — R.A.F. March Past.

I suppose the main appeal must lie with those who have present or past connection with the R.A.F., especially those with nostalgic memories of service days, but there is enough music here of general appeal to warrant wider sales. (H.A.T.)

★ ★ ★

THE GRAND ONE. Cecil Cranfield playing the Grand Concert Organ, Town Hall, Sydney. Stereo, Concert Recording CR-CO14. (From Concert Recording, P.O. Box 108, Wentworthville, N.S.W., 2145).

Interest: One of the largest.
Performance: Capable.
Quality: Ponderous, rather dull.
Stereo: Modest.

The name of Cecil Cranfield brings back memories of pleasant evenings at the large but now deserted theatre at Auburn, Sydney; and of the pleasant half-hour sessions of theatre-organ music over the A.B.C. network a few years back. Nowadays, Cecil Cranfield is to be found upstairs at Palings, in Sydney, surrounded by Hammonds.

It is a rather long jump from all this to the 5-manual console of Sydney's huge — and rather venerable — Town Hall organ, at one time the largest in the world and still the largest in the Southern Hemisphere. However, Cecil Cranfield seems quite at home amid the intricacies of the old pneumatically operated console and determined, unless I miss my guess, to exploit the big pipes to the full.

If this were balanced by the organ's natural brilliance at the other end of the register, the effect might have been

very impressive. Unfortunately, however, the microphones have caught so much of the air and other extraneous noises, that the recordist has presumably elected to cut back the treble, dulling the sound intolerably. Turning up the treble boost gives some hint to the sacrifice which has been made.

The track titles are: Now Thank We All Our God — Creation's Hymn (Beethoven) — Prelude in C-sharp Minor (Rachmaninoff) — Prelude in C-minor (Chopin) — Agnus Dei (Mozart) — Old Hundredth — Nabucco Overture (Verdi) — War March of the Priests (Mendelssohn) — Adeste Fideles — Prelude in A-major (Chopin).

As a recording of ponderous organ bass, the album is impressive. As a recording of how the organ really sounds, it is disappointing. (W.N.W.)

★ ★ ★

SWEET SWEET SOUL — Dick Hyman. Command Records (Festival). Stereo SNDL 932951 (also in mono).

Interest: Studio soul.
Performance: Tends to become monotonous.
Quality: Superb recording.
Stereo: Effective spread.

Dick Hyman is a 41-year-old arranger-conductor-musician, who is very active in the New York Studios. Over the years, he has worked with famous leaders like Red Norvo and Benny Goodman and he was, for some time, musical director for the Arthur Godfrey Show.

Hyman is undoubtedly a very able pianist and organist (on this album he also plays the clavinette, an electronic piano) and he received strong support from two well-known musicians, Bobby Rosengarden on drums and Bob Haggart on bass.

But the basic conception of the album is monotonous with the trio working their way through some recent "soul" hits like "Chain of Fools" and "Dock of the Bay." Fortunately, they also included some standards like "Nobody Knows You" and "Try a Little Tenderness," the best tracks on the album. Even with overdubbing of Hyman's three instruments, the sound (and much of the material) is limited and tends to become a little boring.

The recording quality, as usual with Command, is magnificent and the album plays for 35 minutes. (T.F.C.)

★ ★ ★

DUETS. Victoria de los Angeles, soprano, Dietrich Fischer-Dieskau, baritone, with Gerald Moore, piano. World Record Club Stereo S/4390.

Interest: Classical vocal duets.
Performance: Quite delightful.
Quality: Very good.
Stereo: Well channelled.

When three such eminent artists as those featured here collaborate in a recital the result is bound to be something special, and in fact I found this disc pure delight from start to finish. Victoria de los Angeles is right at the top of her form, with a precision of pitch and purity of tone quite beyond criticism. Fischer-Dieskau goes to great pains not to overshadow his partner with the power of his delivery, and consequently sounds just a trifle subdued. Gerald Moore provides his usual exemplary accompaniment.

The material is very wide ranging, comprising the following: Let Us Wander (Purcell) — Lost is My Quiet (Purcell) — Schlaf in Deiner Engen Kammer (Haydn) — Ah, Lamenta, Oh Bella Irene (J. C. Bach) — Oh! Would I Were That Sweet Linnet (Beethoven) — He Promised Me at Parting (Beethoven) — They Bid Me Slight My Dermott Dear (Beethoven) — A Dream (Beethoven) — Mignon und der Harfner (Schubert) — Le Trebuchet (Berlioz) — Moglichkeit (Dvorak) — Der Apfel (Dvorak) — Schottische Ballade, Op.46, No. 2 (Tchaikowsky) — Pastorale (Destouches — Saint Saens) — Pleurs D'Or (Samain-Faure). Familiar tunes occasionally crop up unexpectedly. The Haydn work has the tune of "All Through the Night" and for "He Promised Me" Beethoven has adapted a popular Scottish folk tune. (All the Beethoven pieces are settings of British folk songs).

The songs are all sung in their original languages, involving English, German, French and Italian, but a leaflet is provided containing the full texts with English translation where necessary. The technical quality of the disc is of a high standard. This is a disc which can be recommended without reservations. (H.A.T.)

★ ★ ★

THIS IS ROLF HARRIS. Columbia (E.M.I.) Mono OSX 7861.

Interest: Popular entertainer.
Performance: Full of laughs.
Quality: Good standard, mono only.

Containing 13 of the songs, mainly traditional and his own, that Rolf Harris has made famous, this disc is fine entertainment for all ages. Rolf Harris has that special quality that appeals to infants and octogenarians, teenagers and parents—in fact, I know no single person who does not enjoy his material immensely. Side 2 tracks have audience participation and although there is no sleeve note, it is a pretty safe bet that it has been extracted from the sound track of video recordings of the B.B.C.'s popular "Rolf Harris Show." The sound is of good standard without being outstanding, and is in mono only.

The selection comprises: Tie Me Kangaroo Down, Sport — Nick Teen and Al K. Hole — The Big Black Hat — Sun Arise — The Master from the Bush — Six White Boomers — The Court of King Caractacus — Click Go the Shears — Wild Colonial Boy — Sydney Town — Big Dog — Jake the Peg — If I Were a Rich Man. (H.A.T.)

★ ★ ★

VALLEY OF THE DOLLS — Dionne Warwick. Scepter Records (Festival). Stereo SJL 932,842 (also in mono).

Interest: A great popular singer.
Performance: Not her best album.
Quality: Very well recorded.
Stereo: Evenly spread.

It is generally agreed that Dionne Warwick is one of the finest popular singers in the world today. She sings beautifully in tune, phrases intelligently, and interprets a lyric with great feeling and sensitivity. However, she undoubtedly works at her best on Bacharach/David compositions with Bach-

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arach arrangements and this is the case with only half of the tracks on this album. Indeed, three or four of the tunes, including the title track, are rather unimpressive.

I did enjoy "San Jose" (recently a very big single for her), "Let Me Be Lonely" and "Where Would I Go" of the Bacharach/David compositions; and "You're My World," "Silent Voices" and "For the Rest of My Life."

Burt Bacharach's six arrangements are all superb, as is Pat Williams' score for "You're My World." While there are superior Dionne Warwick albums in the catalogue, it is well worth hearing and her many admirers will, no doubt, wish to add it to their collections.

The playing time, however, is unreasonably short at 31 minutes, there is no sleeve note and the listing of the tunes on the cover bears no relation to the playing-order. (T.F.C.)

★ ★ ★

ACT III—Lana Cantrell. RCA Stereo LSP 3947 (also in mono).

Interest: Cantrell's third album.
Performance: Disappointing.
Quality: Superbly recorded.
Stereo: Good spread.

In my review of Lana Cantrell's second album for RCA ("Another Shade of Lana"), I said that "despite her success in America, I rather fancy that Miss Cantrell's talent has been somewhat over-rated." There is nothing in this third album to change that opinion. On the contrary, I consider it to be considerably inferior to "Another Shade."

Miss Cantrell has a strident edge to her voice which grates a little on me. Her vocal mannerisms, and in particular her over-dramatic reading of ballads, also become irritating.

But the main problem with this album is the absence of really striking songs. There are disastrous versions of "Hold On, I'm Coming" and "What Now My Love" and, for the rest, the material is generally mediocre. The album includes several French songs and indeed the two Aznavour songs "I Will Warm Your Heart" and "Love At Last You Have Found Me" are the most interesting on the album.

The arrangements, however, by Chuck Sagle are very impressive, as is the recording quality. In all the circumstances, it is unfortunate that the record is so disappointing. (T.F.C.)

★ ★ ★

THE MAN WHO INVENTED SOUL —Sam Cooke. RCA Stereo LSP-3991 (also in mono).

Interest: Reissue material.
Performance: Poor value.
Quality: Acceptable.
Stereo: Not particularly effective.

With the rising popularity of the new breed of "soul" singers (Otis Redding, Aretha Franklin et al.), RCA can hardly be blamed for re-issuing tracks by the very talented Sam Cooke, who died in rather tragic circumstances at the end of 1964. At that time, Cooke was probably past the peak of his career, which had been enormously successful in the 1950s.

The sleeve note (unusually so for Mike Lipskin, the producer of the album) gives no details of the 11 tracks but two, "Blowin' In the Wind" and "Nobody Knows You," were recorded "live" probably near the time of his death. Some of the other tracks, notably "The Great Pretender" and "Danny Boy," are certainly older recordings from the mid-fifties. The track I enjoyed best, however, was the beautiful ballad, "Willow Weep For Me."

This is an enjoyable enough album, which Sam Cooke collectors will probably wish to investigate. But 11 tracks and a playing time of only 31 minutes is simply not good enough for re-issued material. (T.F.C.)

★ ★ ★

THE BEST OF ELLA — Ella Fitzgerald, Calendar (Festival) Mono R66-418.

Interest: Late 1930s to early 1950s.
Performance: Enjoyable but hardly her best.
Quality: Fair for the period.

Despite the warm praise which Ella Fitzgerald's singing has attracted over the years, I have never really been moved by her records or concerts. At the same time, however, I gladly recognise her great technical abilities.

This album, which is scarcely a collection of her finest tracks, has been compiled from her many recording sessions for Decca, to whom she was contracted between 1936 and 1955. In that year, she signed for Norman Granz's Verve label.

In the absence of a sleeve-note (normal for Calendar) I have been unable to track down the discographical details for many of the 12 tracks. But "Tisket," "Undecided" and "Stairway to the Stairs" were certainly recorded in 1938 and 1939 with the Chick Webb Band. There is also one very dated track with the "Inkspots" ("Into Each Life"), while "Paper Moon" and "Flying Home" probably come from the mid 1940s.

The tracks on the second side include "Old Black Magic," "My One and Only Love" and "Lover Come Back to Me" and were, I think, recorded in the late 1940s and early 1950s, when Ella was singing fairly commercial material with a studio big band.

I enjoyed this rather more than I expected, but it is, nevertheless, an album mainly for the Fitzgerald enthusiasts — of whom there are many. At $2.95, and with a playing time of 34½ minutes, it represents pretty fair value for them. (T.F.C.).

★ ★ ★

COOL WATER. Slim Whitman. Imperial (Festival) Stereo SIRL-932,-959. Available in Mono.

Interest: C & W standards.
Performance: Pleasing style.
Quality: Very good.
Stereo: Adequate.

Those familiar with the style of country and western singer Slim Whitman will know what to expect — the controlled but relaxed light tenor voice which flows effortlessly and unhurriedly along and moves easily into the falsetto region on occasions. This formula has kept Whitman at the top of the C & W popularity chart for the best part of 20 years and he obviously sees no need to change it. He has moved outside the C & W field on occasions, but the material here is standard C & W songs: Roll, River, Roll — Cool Water — Poor Little Angeline — Wherever You Are —

Too Tired to Care — Once in a Lifetime — Twilla Lee — The Letter Edged in Black — River of Tears — Lonesome Heart — Wind — When I Call on You. A very pleasant disc which can be recommended to buyers of C & W discs. (H.A.T.).

In brief

WHY SO LONELY. Skeeter Davis. RCA Stereo LSP-3960 (or Mono).

If you like this outstanding young country and western singer, try this one, as you get two Skeeters for the price of one. Throughout the 12 tracks, she sings duets with herself in close harmony, by means of dubbed tracks. Track titles include: Why So Lonely — Burning a Hole in My Mind — Promises, Promises — The Most Wanted Man — Lonely Again — You Mean the World to Me. Tunes and lyrics are completely typical of C & W material. Sound is of excellent quality, with good stereo spread. The two voices of Skeeter are kept in the centre. (H.A.T.)

★ ★ ★

THE LOOK OF LOVE. Laurindo Almeido, guitar, with orchestra. Capitol (E.M.I.) Stereo ST 2866.

This disc can be summed up in a few words. Master guitarist Laurindo Almeido plays coolly and elegantly a collection of love songs, backed by an accomplished strings and woodwind group, in fine arrangements by Lex de Azevedo, Clare Fisher and Dick Grove. Excellent sound. Good tunes; Windy — Angel Eyes — I Love You — Up, Up and Away — Don't Sleep in the Subway — The Look of Love — When I Look in Your Eyes — Alfie — A Beautiful Friendship — Simplicaded — My Own True Love. (H.A.T.)

Popular Jazz

GREATEST HITS — Benny Goodman. CBS Records, stereo SBP 233538 (also in mono).

Interest: Big band and Sextet, 1938-1945.
Performance: Useful reissue.
Quality: Only fair.
Stereo: Electronically re-channelled.

It is now about 30 years since Benny Goodman was at the height of his phenomenal popularity. Goodman himself was, and still is, a remarkably gifted clarinettist technically, but he was never a jazz soloist of the top rank; nor, indeed was his band really outstanding in jazz terms.

His success derived from the combination of a variety of factors, including his policy of employing the very best musicians, his own formidable talents as a businessman and publicist and outstanding arrangements by men like Edgar Sampson. Deane Kincaide and, most off all, Fletcher Henderson.

The best of Goodman's recorded output was done for the Victor label between 1935 and 1938 but, nevertheless, this collection is far from being second-rate. It includes, for example, two tracks ("Sing, Sing, Sing" and "Don't Be That Way") from the famous 1938 Carnegie Hall Concert: "Flying Home" by the 1939 Sextet with Charlie Christian; a very good "Air Mail Special" by the 1941 band with Cootie Williams. Lou McGarity and Jo Jones; and Goodman's own 1941 virtuoso feature, "Clarinet a la King."

The quality of Goodman's records slumped considerably after 1941 but the three tracks from 1942-45 which are included here, notably "Jersey Bounce," are reasonably good.

All in all, this is a useful collection, particularly for those with only a few Goodman albums in their collections. The playing time, incidentally, is extremely generous at 51 minutes. (T.F.C.)

★ ★ ★

COME TO THE CABARET — The Dukes of Dixieland. Festival, Stereo SDL 932,815 (also in mono).

Interest: Commercial Dixieland.
Performance: Well drilled.
Quality: Brightly recorded.
Stereo: Good separation.

With the general decline of interest in Dixieland, many bands the world over have had to adopt an aggressively commercial policy to survive. Good examples of this are the Dutch Swing College Band and England's Kenny Ball Jazzmen.

Ever since the Dukes of Dixieland rose to national popularity in America some 10 years ago, they have followed a policy of commercial Dixieland but, fortunately, the current band is not as unpleasant as it once was.

The main drawback about this album is the poor material. Popular songs like "Up Up and Away," "Don't Sleep In The Subway" and "Smile" scarcely fit Dixieland requirements.

Frank Assunto takes some passable trumpet solos, although his two vocals were grave mistakes, while the pianist (probably Gene Schroeder) plays well throughout. The rhythm section, however, is lumpy, the tracks are too short and the general involvement is slight.

This is a well-drilled, harmless enough machine producing relatively unimportant music. But even under these circumstances, a $5.75 issue should surely contain more than 25½ minutes of music. (T.F.C.)

★ ★ ★

INDO-JAZZ FUSIONS II—Joe Harriott-John Mayer Double Quintet Columbia Lansdowne Series (EMI) Stereo SCXO 6215.

Interest: Integration of modern jazz and Indian music.
Performance: Most successful of the three albums.
Quality: Excellent clarity in sound.
Stereo: Superbly balanced.

When I reviewed the second Harriott/Mayer album (Indo-Jazz Fusions) in these pages, I commented that "there was a significantly greater degree of integration and teamwork" than on the first album (Indo-Jazz Suite).

That assessment, I think, applies with even more force to this, the third album by the Harriott/Mayer Double Quintet. From the standpoint of exploring a meaningful common ground between modern jazz and Indian

music, this album must be judged the most successful.

The Indian musicians appear to me to display a greater awareness and understanding of the jazz idiom, while the jazzmen seem less uncomfortable and tentative with the very complex Indian musical forms. This applies particularly to Joe Harriott who turns in some thoughtful solos.

There are four extremely attractive compositions on the album of which the Indian violinist, John Mayer, wrote all but one—"Mishra Blues" on which Mayer collaborated with Harriott's pianist, Pat Smythe. I enjoyed the slow haunting "Song Before Sunrise" most of all, but "Raga Piloo" and "Mishra Blues" are somewhat easier to understand for one not familiar with the complexities of Indian music.

It should be said that the successful fusion of the two musics has been substantially at the expense of the orthodox jazz elements. I still hold the view that these attempts at integration promise little of genuine substance for modern jazz. (T.F.C.)

★ ★ ★

THE LAST TIME WE SAW PARIS — Dave Brubeck Quartet. C.B.S. Records, stereo SBP 233567 (also in mono).

Interest: Quartet's last European Concert.
Performance: Mainly superior Brubeck.
Quality: Excellent for "live" recording.
Stereo: well balanced.

Now that the Brubeck Quartet has disbanded, I must confess that I feel twinges of nostalgia. Although I have never been an enthusiastic supporter of their music, I readily acknowledge, for example, the individual talents of Paul Desmond and Joe Morello, together with Brubeck's very considerable composing abilities.

By all accounts, Columbia have a considerable number of recording sessions by the Quartet in the vaults for future release. This album, for example, was taped on November 13, 1967, at the group's final European Concert in Paris. All the material is familiar, although these live performances are, in each case, significantly different and, on balance, better than the previous versions on record.

The best track in the album is Brubeck's own composition "One Moment Worth Years," with Desmond in particularly lyrical and graceful form. "Those Foolish Things," a beautiful ballad, is perhaps taken a shade fast for comfort but this version of "La Paloma Azul" (from "Bravo Brubeck!") is impressive. "Swanee River" is fast and Brubeck is particularly prone to cliches and heavy-handedness on this track.

Unfortunately, two of the Quartet's tedious exercises in polyphony and polytonality, "Forty Days" and "Three To Get Ready," were featured at this concert, but even they are more enjoyable than on the original albums.

This release shows all too clearly the best and worst aspects of the Quartet's work. However, judging by the applause, the Paris audience seemed to be most enthusiastic and Brubeck collectors will no doubt enjoy the album. The playing time is extremely favourable at 49 minutes. (T.F.C.) ■

AUSTRALIAN TELEVISION STATIONS

Area	Call	Channel/ Polarity
A.C.T.		
Canberra	ABC	3-V
	CTC	7-V
New South Wales		
Sydney	ABN	2-H
	ATN	7-H
	TCN	9-H
	TEN	10-H
Bega-Cooma	ABSN	8-V
Broken Hill	ABLN	2-V
	BKN	7-V
Cent. Tablelands	ABCN	1-V
	CBN	8-V
Cent. W. Slopes	ABQN	5-V
	CWN	6-V
Grafton-Kempsey	ABDN	2-H
	NRN	11-H
Illawarra	WIN	4-H
	ABWN	5A-H
Manning River	ABTN	1-V
	ECN	8-V
Murrumbidgee	ABGN	7-H
	MTN	9-H
Newcastle-Hunter	NBN	3-H
	ABHN	5-H
Richmond-Tweed	ABRN	6-H
	RTN	8-H
S.W. Slopes and E. Riverina	ABMN	0-H
	RVN	2-H
Upper Namoi	ABUN	7-H
	NEN	9-H
Victoria		
Melbourne	ATV	0-H
	ABV	2-H
	HSV	7-H
	GTV	9-H
Ballarat	ABRV	3-H
	BTV	6-H
Bendigo	ABEV	1-V
	BCV	8-V
Goulburn Valley	ABGV	3-V
	GMV	6-V
Latrobe Valley	ABLV	4-H
	GLV	10-H
Mildura	ABMV	4-H
	STV	8-H
Murray Valley	ABSV	2-V
Upper Murray	ABAV	1-H
	AMV	4-H
Queensland		
Brisbane	TVQ	0-H
	ABQ	2-H
	BTQ	7-H
	QTQ	9-H
Cairns	ABNQ[3]	9-H
	FNQ[3]	10-H
Darling Downs	ABDQ	3-H
	DDQ	10-H
Mackay	ABMQ	4-H
	MVQ	6-H
Mount Isa	AB—[1]	6-H
Rockhampton	ABRQ	3-H
	RTQ	7-H
Southern Downs	ABSQ	1-H
	SDQ	4-H
Townsville	ABTQ	3-H
	TNQ	7-H
Wide Bay	ABWQ	6-V
	WBQ	8-V
South Australia		
Adelaide	ABS	2-H
	ADS	7-H
	NWS	9-H
	SAS	10-H
Renmark	AB—[1]	3-V
South East	ABGS	1-H
	SES	8-H
Spencer Gulf N.	ABNS	1-V
	GTS	4-V
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Perth	ABW	2-H
	TVW	7-H
	STW	9-H
Bunbury	BTW	3-H
	ABSW	5-H
Cent. Agricultural	ABCW	4-H
Geraldton	AB—[1]	6-H
Kalgoorlie	AB—[1]	6-H
S. Agricultural	ABAW	2-V
	GSW	9-V
Tasmania		
Hobart	ABT	2-H
	TVT	6-H
N.E. Tasmania	ABNT	3-H
	TNT	9-H
Northern Territory		
Darwin	AB—[1]	6-H

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	WIN-4	11-H
Bonalbo	ABRN-6	3-V
	RTN-8	5-V
Cobar	CWN-6[1]	—[2]
Cooma	ABSN-8[1]	0-M
	CTC-7	10-V
Glen Innes	ABUN-7	0-H
	NEN-9	3-H
Goulburn	ABC-3	0-V
	CTC-7	10-V
Kandos-Rylstone	ABCN-1[1]	0-V
Kyogle	ABRN-6	3-V
	RTN-8	5-V
Lithgow	ABCN-1	5-V
	CBN-8 (Mod —1MHz)	6-V
Mudgee	CWN-6[1]	9-V
	CWN-6[3]	11-V
	ABQN-5[1]	11-V
Murwillumbah	RTN-8	5-H
Snowy Mountains (Khancoban)	AMV-4	10-H
Walcha	NEN-9	1-H
	ABUN-7	5-H
Victoria		
Alexandra	ABGV-3[1]	5-H
	GMV-6[1]	10-H
Eildon (via Alexandra)	ABGV-3[1]	1-H
	GMV-6[1]	3-H
Myrtleford	ABGV-3[1]	2-H
	AMV-4[1]	9-H
Nhill	ABRV-3[1]	9-V
Orbost	ABLV-4[1]	2-V
Portland	ABRV-3	4-H
	BTV-6	11-H
Swan Hill	BCV-8	11-V
Warrnambool-Port Fairy	ABRV-3	2-V
	BTV-6	9-V
Queensland		
Cardstone Village	TNQ-7[3]	5-V
Cracow	RTQ-7	5-H
Gympie	WBQ-8[1]	1-V
	ABWQ-6[1]	4-V
Monto	ABWQ-6	1-V
	WBQ-8[1]	5-V
North Townsville	TNQ-7	9-H
	ABTQ-3	10-H
South Australia		
Bordertown	ABS-2[1]	2-V
Cowell	ABNS-1[1]	6-V
Keith	ABS-2[1]	4-V
Port Lincoln (via Cowell)	ABNS-1[1]	3-H
Tasmania		
Gowrie Park	TNT-9	1-H
	ABNT-3[1]	11-H
Maydena	TVT-6	8-H
Queenstown-Zeehan	ABT-2	4-H
	TVT-6	8-H

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[2] Not yet determined.
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2	63-70	8	188-195
3	85-92	9	195-202
4	94-101	10	208-215
5	101-108	11	215-222
5A	137-144		

AUSTRALIAN BROADCAST STATIONS

MEDIUM-WAVE STATIONS

Frequency KHz	Call	Location		Power Watts
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	3UL	Warragul	d	2K
	4KZ	Innisfail-Tully	d	2K
	6DL	Dalwallinu	n	10K
540	4QL	Longreach	n	10K
	7SD	Scottsdale	d	2K
550	2CR	Orange	n	50K
560	2ML	Murwillumbah	n	200
	4AM	Atherton	d	2K
	6WA	Wagin	n	50K
	7BU	Burnie		2K[1]
580	3WV	Horsham	n	50K
590	4QR	Brisbane	n	50K
600	4AT	Atherton	n	4K[1]
	6NM	Northam	n	200
	6PH	Port Hedland	n	2K
	7ZL	Hobart	n	10K
610	2FC	Sydney	n	50K
620	3AR	Melbourne	n	50K
630	4QN	Townsville	n	50K
	7QN	Queenstown	n	400
640	5CK	Port Pirie	n	10K
650	2NU	Tamworth	n	10K
	6AL	Albany	n	400
	8DR	Darwin	n	2K
660	2BH	Broken Hill		200
	6GF	Kalgoorlie	n	2K
670	2CO	Albury	n	10K
	6BE	Broome	n	50
	8KN	Katherine	n	50
680	2KP	Kempsey	n	10K
	6BS	Busselton[2]	n	2K
	8TC	Tennant Creek	n	50
690	4KQ	Brisbane		2K
	6WF	Perth[3]	n	50K
700	2NR	Grafton	n	50K
710	4QW	St. George	dn	10K
	7NT	Launceston	dn	10K
720	2TR	Taree	n	200
	4QA	Mackay	n	2K
	6CA	Carnarvon[4]	n	200
	7QT	Queenstown		500
730	5CL	Adelaide	n	50K
740	2BL	Sydney	n	50K
750	4QS	Toowoomba	n	10K
760	2AN	Armidale	n	50
	2NB	Broken Hill	n	1K
770	3LO	Melbourne	n	50K
780	2KA	Katoomba		2K
	4TO	Townsville		2K
	6WA	Albany		2K
790	4QG	Brisbane	n	10K
800	5RM	Renmark		2K
810	2BA	Bega	n	10K
	6WN	Perth	n	10K
	9RB	Rabaul	n	2K
820	2GL	Glen Innes	n	10K
830	3GI	Sale	n	10K
	6GN	Geraldton	n	2K
840	4RK	Rockhampton	n	10K
	6ED	Esperance	n	1K
850	2CY	Canberra	n	10K
860	4GR	Toowoomba		2K
	6AM	Northam		2K
	7HO	Hobart		2K
870	2GB	Sydney		5K
	6DB	Derby	n	2K
880	4WK	Warwick		2K[1]
	6PR	Perth		2K
890	5AN	Adelaide	n	50K
900	2LM	Lismore		2K
	6BY	Bridgetown		2K
	7AD	Devonport		2K[1]
910	4QB	Maryborough	dn	10K
	4QO	Eidsvold	n	10K
920	2XL	Cooma		2K[1]
	4VL	Charleville		2K[1]
	6NA	Narrogin		2K
930	3UZ	Melbourne		5K
	4—	Gladstone[2]	d	2K
940	4QY	Cairns	n	2K
	7ZR	Hobart	dn	10K
950	2UE	Sydney		5K
960	3BO	Bendigo		2K
	4AY	Ayr		2K
	6TZ	Bunbury		2K
970	5DN	Adelaide		2K
980	6KG	Kalgoorlie		2K
990	2GZ	Orange.		2K
1000	3HA	Hamilton		2K
	4RO	Rockhampton		2K
	6PM	Perth		2K
1010	4CA	Cairns		2K
	4IP	Ipswich		2K
	6GE	Geraldton		2K
	7EX	Launceston		2K
1020	2KY	Sydney		5K
1030	3DB	Melbourne		5K
1040	2UH	Muswellbrook	dn	1K
	5PI	Crystal Brook		2K
1050	2CA	Canberra		2K
1060	4SB	Kingaroy		2K
1070	2RG	Griffith		2K[1]
	6WB	Katanning		2K
1080	2MO	Gunnedah		2K[1]
	4MI	Mt Isa	n	200
	6IX	Perth		2K
	7HT	Hobart		2K
1090	3LK	Lubeck		2K
1100	4LG	Longreach		2K
	6MD	Merredin		2K
	7LA	Launceston		2K
1110	2UW	Sydney		5K[1]
1120	4BC	Brisbane		2K
1130	2AD	Armidale	d	2K
	3CS	Colac	d	2K
	6CI	Collie		2K
1140	2HD	Newcastle		2K
1150	2WG	Wagga		2K
1160	4MB	Maryborough		2K
	5PA	Penola[5]	n	2K
1170	2CH	Sydney		5K
1180	3KZ	Melbourne		5K
1190	2NZ	Inverell		2K
1200	4GG	Gold Coast	d	2K
	5KA	Adelaide		2K
1210	2GF	Grafton		2K
	3YB	Warrnambool		2K
	6KY	Perth		2K
1220	4AK	Oakey		2K
	5—	Port Lincoln[2]	d	2K
1230	2NC	Newcastle	n	10K
1240	3TR	Sale		2K
	8DN	Darwin		2K
1250	2DU	Dubbo		2K
	9PA	Port Moresby	n	2K
1260	3SR	Shepparton		2K
1270	2SM	Sydney		5K

MW Stations – contd.

Frequency KHz	Call	Location		Power Watts
1280	3AW	Melbourne		5K
1290	2TM	Tamworth		2K
1300	4BK	Brisbane		2K
1310	5AD	Adelaide		2K
1320	3BA	Ballarat		2K
	4NA	Nambour	d	2K
1330	3SH	Swan Hill		2K
	4BU	Bundaberg		2K
1340	2LF	Young		2K
1350	3GL	Geelong		2K
	4GY	Gympie		2K
1360	2NX	Bolwarra		2K
1370	2LT	Lithgow		500
	4LM	Mount Isa		2K
	5SE	Mount Gambier		500
1380	2GN	Goulburn		2K
	4MK	Mackay		2K
1390	4BH	Brisbane	d	2K
1400	2PK	Parkes		2K
1410	2KO	Newcastle		2K
1420	3XY	Melbourne		5K
1430	2WL	Wollongong		2K
1440	2MW	Murwillumbah		2K
	3CV	Maryborough		2K
1450	2MG	Mudgee	d	2K
	5AU	Port Augusta	d	2K
1460	2NM	Muswellbrook		2K[1]
	5MU	Murray Bridge		2K[1]
1470	3MA	Mildura		2K
1480	2BE	Bega		2K[1]
	4ZR	Roma		2K[1]
1490	2AY	Albury		2K
1500	2BS	Bathurst	d	2K
	3AK	Melbourne	d	5K
1510	2NA	Newcastle	n	10K
1520	2QN	Deniliquin		2K
1530	2VM	Moree		2K[1]
	5LN	Port Lincoln	n	200
	8AL	Alice Springs	n	50
1540	2CN	Canberra	n	2K
1550	4QD	Emerald	n	50K
1560	2RE	Taree		2K
1570	2CP	Cooma	n	50
	2LG	Lithgow	n	200
	3WL	Warrnambool	n	200
	4GM	Gympie	n	200
1580	2WN	Wollongong	n	2K
	5MG	Mount Gambier	n	200
	5WM	Woomera	n	50K
1590	4SQ	Southport	n	200
	5MV	Renmark	n	2K
1600	3NE	Wangaratta		2K[1]

All call signs commence with a number which indicates the state or territory in which the station is located, the numbers being allocated:

2 N.S.W. (including A.C.T.).
3 Victoria.
4 Queensland.
5 South Australia.
6 Western Australia.
7 Tasmania.
8 Northern Territory.
9 Territory of Papua and New Guinea.

d Uses directional aerial.
n National Broadcasting Service.
[1] Operates at night or during specified periods on reduced (usually half) power.
[2] Projected station.
[3] Frequency to be changed to 720KHz.
[4] Frequency to be changed to 850KHz.
[5] To be relocated at Naracoorte with directional aerial and power increased to 10KW.

SHORT-WAVE STATIONS

The Australian Broadcasting Commission has ten short-wave stations intended to provide services for listeners in the more remote part of the Commonwealth and in the Territories. The frequencies on which they transmit are varied as required to obtain optimum results.

The short-wave service transmits programs obtained as follows: VLI takes N.S.W. regional programs; VLG takes Victorian regional programs and relays Radio Australia, VLH relays 3AR and VLR relays 3LO; VLM and VLQ take Queensland regional programs; VLW and VLX take Western Australian regional programs; VLK and VLT relay 9PA.

Call	Location	Power Watts
VLG	Melbourne	10K
VLH	Melbourne	10K
VLI	Sydney	2K
VLK	Port Moresby	10K
VLM	Brisbane	10K
VLQ	Brisbane	10K
VLR	Melbourne	10K
VLT	Port Moresby	10K
VLW	Perth	10K
VLX	Perth	50K

Radio Australia

Transmitters for the overseas service of Radio Australia are located at Shepparton, Vic. (4 x 100KW, 2 x 50KW and 1 x 10KW), Lyndhurst, Vic. (2 x 10KW), and Darwin, N.T. (3 x 250KW). These stations are capable of operating on various frequencies and aerials as required to give best reception in the selected areas. In common with all international broadcasting stations, Radio Australia has no assigned frequencies, but is allocated certain frequencies for use during definite periods.

TRANSLATOR STATIONS—contd.

Tasmania

Area	Parent Station	Channel/ Polarity
Rosebery-Renison Bell (via Queenstown)	ABT-2	1-H
	TVT-6	10-H
St. Marys-Fingal Valley	ABNT-3	1-V
	TNT-9	11-V
Savage River-Luina (via Waratah)	ABNT-3[1]	2-H
	TNT-9	7-H
South Launceston	ABNT-3	1-H
	TNT-9	11-H
Stanley	ABNT-3	1-V
	TNT-9	6-V
Swansea-Bicheno	TVT-6	8-H-Swansea V-Bicheno
Taroona	TVT-6	8-H
Waratah	ABNT-3[1]	2-H
	TNT-9	10-H

NORFOLK ISLAND

A local service is provided by the Norfolk Island Administration under the technical direction of the Department of Civil Aviation.

Frequency KHz	Call	Location	Power Watts
1570	2NI	Kingston	50

PAPUA/NEW GUINEA

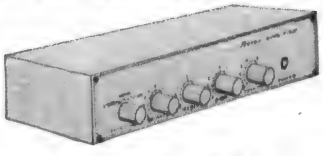
In addition to the services provided by the Australian Broadcasting Commission on medium wave (9PA and 9RB) and on short wave (VLK and VLT), the Department of Information and Extension Services provides a number of short-wave stations.

Frequency KHz	Call	Location	Power Watts
2410	9CG	Goroka	250
2450	9CH	Mount Hagen	250
3235	8AS	Samarai	250
3245	8BK	Kerema	250
3305	8BD	Daru	10K
3322	9BA	Kieta	2K
3335	9CD	Wewak	10K
3385	9BR	Rabaul	10K

WARBURTON FRANKI

NEW

SOLID STATE 10 WATT STEREO AMPLIFIER KIT



Australian made by S.T.C. Everything supplied including cabinet and full instructions.

Specifications: 10 Watts R.M.S. per channel. Continuous Sine Wave into 4 ohm load.
Response: ± 1dB 100 Hz—25KHz. ±3dB 15Hz—50KHz at 1 watt output.
Noise and Distortion: —69dB at 1 watt.
Channel Separation: Over 50dB.
Output Impedance: 4 to 16 ohms.
Input Sensitivity: Main Power Amplifier 660mv input for max. undistorted output. Overall sensitivity 7.2mv.

Two Versions Available

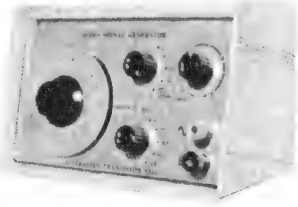
1. For use with ceramic pickup.
2. For use with magnetic pickup.

$95.00
Freight free.

NEW

SOLID STATE AUDIO SIGNAL GENERATOR

MODEL 100



- 15Hz to 1.5MHz in 5 bands.
- 0-800mv (0 to 2.5v p-p) with both stepped and fine controls.
- Less than 2% distortion.
- 9-volt battery-operated.
- Australian made.

$48.50 Freight Free

NEW

INSTRUMENT CASES

As used for above signal generator. Size: 7½in x 4½in x 4½in. Tough plastic case with aluminium panel. May be used for instruments, intercoms, extension speakers, etc.

$3.75 Freight Free

BINOCULARS

Superoptic Brand

- Coated lenses.
- Centre focusing—with separate right eye adjustment.
- Precision manufacture.
- Complete with leather case and straps.

8 x 30 $17.50
7 x 50 $19.50
Freight Free

NEW

"CADET" SPEED CONTROLLER FOR ELECTRIC HAND TOOLS

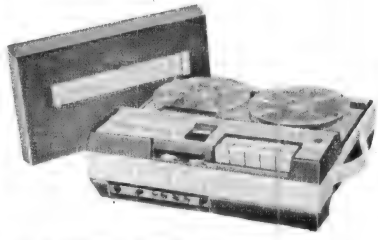
Varies speed from stop to full speed with no loss of torque. Rated capacity 2 amps. Complete with flex and plug.

$11.50
Freight Free

NEW

AWA SOLID STATE TAPE RECORDER

MODEL T225UA



- 2-track, 2-speed.
- Takes 5in reels.
- Microphone — Dynamic with switch.
- Push-button operation.
- Powered by A.C. mains or internal batteries.

$95.00
Freight Free

POLYPACS

SPECIAL CONDENSER POLYPAC No. 20

Contains 25 assorted condensers, including ceramic, electrolytic, metal pack, mica, paper tubular. **$1** plus postage 10c (or five for **$5**, post free).

CERAMIC CONDENSER POLYPAC No. 21

25 assorted ceramic condensers—**$1** plus 10c pack and post (or five for **$5**, post free).

ELECTROLYTIC CONDENSER POLYPAC No. 22

12 assorted miniature electrolytic condensers—**$1** plus 10c pack and post (or five for **$5**, post free).

RESISTOR POLYPAC No. 23

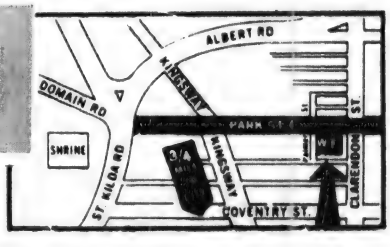
50 assorted ½-watt resistors—**$1** plus 10c pack and post (or five for **$5**, post free).
Above Polypacs may be assorted to get concession price of 5 for $5, post free.

RESISTOR POLYPAC No. 24

20 Hi-stability 1-watt ± 1% resistors, **$3.50** plus 10c pack and post.
Values may be specified, but if not in stock nearest will be supplied.

WARBURTON FRANKI

220 PARK ST., STH. MELB., VIC. Ph. 69-0151 (30 lines)



NEW ZEALAND RADIO, TELEVISION

TELEVISION STATIONS

Location	Call	Channel
Wellington		
Mt. Kaukau	WNTV	1
Repeater Stations		
Blenheim	WNTV	6
Dawson's Falls	WNTV	9
Hicks Bay	WNTV	6
Masterton	WNTV	7
Matawai	WNTV	4
Mt. Egmont	WNTV	6
Mt Erin	WNTV	6
Mt. Whakapumake	WNTV	1
Muriwai	WNTV	4
Opunake	WNTV	5
Poutoko	WNTV	4
Pukeiti	WNTV	7
Ruatoria	WNTV	4
Te Puia	WNTV	2
Tokomaru Bay	WNTV	4
Tolaga Bay	WNTV	5
Auckland		
Waiatarua	AKTV	2
Repeater Stations		
Hikurangi	AKTV	3
Horokaka	AKTV	5
Maungataniwha Peak	AKTV	6
Mt. Te Aroha	AKTV	1
Whangarei	AKTV	7
Christchurch		
Sugar Loaf	CRTV	3
Repeater Station		
Mt. Studholme	CRTV	4
Dunedin		
Highcliff	DNTV	2
Repeater Stations		
Hedgehope	DNTV	1
Kuriwao	DNTV	5

Frequencies

Channel	Frequency MHz	Channel	Frequency MHz
1	44-51	6	188-195
2	54-61	7	195-202
3	61-68	8	202-209
4	174-181	9	209-216
5	181-188		

MEDIUM-WAVE BROADCAST STATIONS

Frequency KHz	Call	Location		Power Watts
570	2YA	Wellington		100K
630	2YZ	Napier		20K
640	4YW	Alexandria		2K
660	2YC	Wellington		60K
690	3YA	Christchurch		20K
720	4YZ	Invercargill		20K
750	3ZA	Greymouth	c	2K
760	1YA	Auckland		20K
780	4YA	Dunedin		20K
800	2YB	Wellington		20K
820	4ZA	Invercargill	c	10K
830	1YX	Whangarei		2K
840	2ZD	Masterton	c	2K
860	1YZ	Rotorua		10K
880	1YC	Auckland		10K
900	4YC	Dunedin		10K
920	3YZ	Greymouth		10K
940	2ZA	Palmerston North	c	2K
960	3YC	Christchurch		10K
970	1ZN	Whangarei	c	2K
980	2ZB	Wellington	c	20K
1000	1ZD	Tauranga	c	10K
1040	4ZB	Dunedin	c	10K
1060	2ZG	Gisborne	c	2K
1070	1ZB	Auckland	c	10K
1100	3ZB	Christchurch	c	10K
1130	2ZM	Wellington	c	2K
1140	1YW	Hamilton		2K
1160	3ZC	Timaru	c	2K
1180	2YW	Gisborne		2K
1200	2ZW	Wanganui	c	2K
1220	1ZE	Kaikohe	c	2K
1250	1ZM	Auckland	c	2K
1280	2ZC	Napier	c	2K
1310	1ZH	Hamilton	c	2K
1340	2ZN	Nelson	c	2K
1350	1ZC	Rotorua	c	2K
1370	2ZP	New Plymouth	c	2K
1390	1ZT	Turangi	c	100
1400	3ZM	Christchurch	c	2K
1420	1ZO	Tokoroa	c	2K
1430	4XD	Dunedin		250
1440	1ZK	Kaitaia	c	2K
1460	3YW	Westport		2K
1480	——	Radio Hauraki*	c	2K
1500	1ZA	Taupo	c	2K
1520	1ZU	Taumarunui	c	1K
1540	2ZE	Blenheim	c	1K
1560	2ZH	Hawera	c	1K

c Commercial advertising stations.

* Radio Hauraki operates on board M.V. Tiri, moored in Colville Channel in international waters off the coast of Auckland.

All stations, except 4XD and Radio Hauraki, are operated by the New Zealand Broadcasting Corporation.

SHORT-WAVE SERVICE

Two 7.5KW transmitters for the overseas service of Radio New Zealand are located at Titahi Bay, Wellington. The programs are beamed to the Pacific Islands, Australia and Antarctica in the 49, 31, 25, 19 and 16 metre bands.

The schedule is: to the Pacific Islands, 1700-1945, 2000-0545, and 0600-0845GMT; to Australia, 2000-2230, 2245-0545 and 0900-1145GMT; to Antarctica, Sundays only 0815-0845-GMT.

The call signs and frequencies are:

Call	Frequency KHz	Call	Frequency KHz
ZL20	6020	ZL6	11705
ZL7	6080	ZL3	11780
ZL18	9520	ZL22	11820
ZL2	9540	ZL21	15110
ZL8	9620	ZL4	15280
ZL23	9755	ZL5	17770

Overseas Stations Lists

"Electronics Australia" does not publish, nor do we have available lists of overseas stations, frequencies, broadcast times, etc. The only information of this type is compiled by our DX correspondent, Mr Art Cushen, and published monthly in the "Listening Around the World" pages.

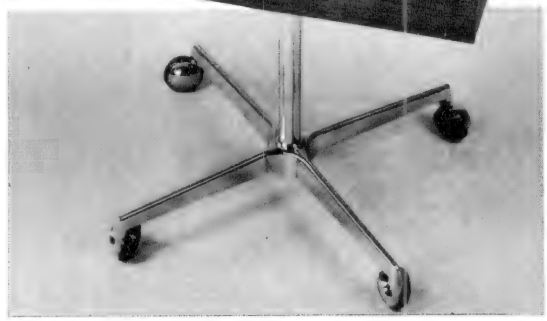
For general information on short-wave and other stations, reference can be made to the "World Radio Handbook," available through most large technical book sellers.

TRADE REVIEWS AND RELEASES

B&O PLAYER, AMPLIFIER, SPEAKERS

G.R.D. Instruments Pty. Ltd. recently submitted for review a line-up of B & O equipment made by Bang and Olufsen of Denmark. The components, which could be used to make up a complete system, were the Beogram 1500, a turntable with integral amplifier; Beovox 2400 speakers; and the Beolit 1000, a portable radio with unusually comprehensive facilities.

The Beogram uses a belt-drive turntable made by SRT of Copenhagen, which is sold as the Labcraft 655 in Australia. This is broadly similar to the Labcraft 605L which has been very popular on the Australian market for quite a while. The turntable has three speeds, 33, 45 and 78 rpm, the motor being an asynchronous type with a centrifugal governor which allows speed adjustment over a range of plus or minus ten per cent.



At right, the Beogram 1500 player-amplifier. Below, one of the Beovox 2400 loudspeakers.

The arm fitted is a version of the B & O type ST/L-15, a counterweighted arm with the tracking weight set by a spring and suitable only for B & O plug-in cartridges. The cartridge supplied was the B & O SP9, which is the top of the line, fitted with an elliptical stylus. It is similar in form to the earlier B & O cartridges except that the flat area on the underside of the shell has been increased, the stylus being arranged to provide the now usual 15-degree vertical tracking angle. The case is gold plated.

The arm is provided with a hydraulically damped lowering device which is operated by a toggle lever at the front right-hand corner of the turntable baseplate. An interesting feature of the lowering device is that the arm has been adapted to use it. Normally, tone arms are mounted so that they are parallel to the record surface but, in this case, the arm is tilted slightly, the pivot being lower than the arm-rest. Nevertheless, the cartridge is correctly oriented to give the 15-degree vertical tracking angle, which is what really matters.

In effect, the turntable is supplied on a slightly larger than normal teak base, in which has been installed a stereo amplifier. The controls, to the right of the turntable, include a two-section, "clutched" volume control, treble and bass controls and four push-buttons to select radio, tape, pick-up or Off. Pushing any of the three buttons for radio, etc., turns the amplifier on. The turntable is started by simply moving the arm from the rest, which incorporates a micro-switch.

Also supplied with the turntable/amplifier was a tinted plastic dust cover which provides a nice finishing touch. In fact, the overall appearance and finish of the Beogram is very good. The turntable baseplate and amplifier panel are finished in satin black which contrasts well with the aluminium knobs of the amplifier and the chromed speed change and lowering controls on the turntable. The turntable has an inset with stroboscope markings for exact setting of the 33rpm speed in conjunction with mains-powered lighting. DIN sockers are provided at the rear of the unit for speaker outlets, for tape recording and replay, and also a low level radio input.

A further accessory for the Beogram 1500 is a chrome-plated pedestal fitted with rubber-tyred ball castors. This is convenient for chairside use. While the pedestal enables the unit to be moved easily, it does not move around when the controls are being used.

To obtain some initial impressions of the performance of the equipment we set up the Beogram 1500 and the Beovox 2400 speakers. Playing typical records at normal control settings, the results were disappointing, with the bass tending to be boomy and the treble sounding muffled. To compensate we tried attenuating the bass and boosting the treble and, while this improved matters, we were still left with an impression of too much "middle" and even wisps of distortion, particularly on brass instruments. Perhaps the natural impulse was to blame the loudspeakers for this coloration but subsequent and independent tests gave a very different verdict.

The Beovox 2400 loudspeakers are designed on the acoustic suspension principle. The cabinet is 23½in long, 9½ inches wide and 10¾ inches deep, being finished on four sides in Brazilian rosewood or teak. They are supplied with stick-on rubber feet and can be used either horizontally or vertically.

The grille is made of perforated steel covered with speaker cloth. It is non-resonant and easily removeable to expose the three loudspeakers — tweeter, mid-range and woofer — which are mounted from the front of the baffle.

The woofer is a low-resonance unit with a nominal diameter of eight inches but the flexible synthetic rubber roll surround gives an effective cone diameter of six inches. The deep curvilinear cone has a resonance in the region of 35-40Hz, according to the specification, while the crossover frequency from woofer to mid-range loudspeaker is specified as 900Hz.

The mid-range speaker is an elliptical unit with nominal dimensions of 5 x 3 inches. It covers the range from 900 to 5KHz after which the tweeter takes over. This latter has a cone diameter of 1½ inches. The impedance of the system is 4 ohms and the overall range of the system is claimed as 40Hz to 18KHz. At the rear of the enclosure is a DIN socket for optional connection to an external tweeter. Use of this socket disables the internal tweeter.

After the initial test referred to above we connected the loudspeakers to a high-powered amplifier with low output impedance and known characteristics and carried out frequency response tests with a sine wave generator. The bass was smooth and controlled with good response down to 40Hz.

The middle range was clean with a just discernible rise at around 2.5KHz. Above this again, the response was smooth and clean up to 10KHz, thereafter tapering off gradually up to the limit of audibility. On music, the overall impression was of brightness with good bass. There seemed to be little need to boost the bass, as is necessary with most smaller, completely sealed loudspeaker sytems. The sensitivity of the system was good and the ten watt per channel amplifier would be quite adequate for the average room. The manufacturer's specification states that the speakers will handle a peak power of

35 watts. Overall, they appealed to us as being very good units indeed.

Having found the Beovox speaker capable of fine reproduction we then moved back to the Beogram.

The construction was very neat and accessible with high-quality plug-in printed circuit board. The transistors appeared to be mostly germanium types and the majority of components were of English manufacture with replacements easily available in Australia. We cannot comment on the circuit configuration as no circuit was supplied.

Power output from the amplifier was 7.6 watts per channel into 4-ohm loads with either channel driven singly while, with both channels driven simultaneously, the power dropped to 7 watts per channel. This is a slight deviation from the manufacturer's claim of 8 watts per channel. The amplifier is suitable for use with loudspeakers with an impedance between 4 and 8 ohms, the higher impedance resulting in some power reduction.

Total harmonic distortion at a level of 1 watt at 1KHz was measured 1.5 per cent, with hum and noise being minor components in the distortion products. Hum and noise were, in fact, very low,

The frequency response was measured with the bass and treble controls set up for equal output at 100Hz, 1KHz and 10KHz at a level of 1 watt into a 4-ohm resistive load. It was measured using the radio input. This gave a frequency response within plus and minus 3dB between 50Hz and 30KHz. There was a broad "hump" centred on 300Hz at level of plus 3dB above reference level at 1KHz.

The radio input had the very high sensitivity of 3mV or better for full output. The settings of the tone controls for the above frequency response test was at "nine o'clock" for the bass control and "twelve o'clock" for the treble control. These settings also gave the best wave shape with a 1KHz square wave input signal. Total range of the bass control was 14dB at 50Hz while that of the treble control was 22dB at 10KHz.

We found it difficult to check the equalisation for the magnetic cartridge without making internal connections. Accordingly, we decided to test the response of the cartridge and amplifier using the CBS STR100 test record. This showed quite a deviation from a normal flat response with the tone controls set as above. There was quite a dip in the curve over the range from 3KHz to 12Kz, with about 12dB boost evident around 100Hz. This corroborated our initial impression that the closest approach to a flat response was obtained with the tone controls set for bass cut and treble boost.

The waveform from the B&O SP9 cartridge itself proved to be clean. We used the recommended tracking weight of 2 grams and at this setting it tracked the plus 8dB low frequency test track on the W & G 25/2434 test record. Separation between channels was good over the entire audio range.

To sum up, the pickup, turntable, mobile base and loudspeakers all warrant commendation, both for their presentation and for their performance to full high fidelity standards. The amplifier unit, however, appears to have been conditioned for the tastes of someone with a fondness for low-level "atmospheric" listening, or just lots of bass and not too much treble. As such, it will appeal to a particular segment of the buying public but not to the ever-growing number of hi-fi enthusiasts whose aural preferences more closely correspond with established response curves.

Price of the Beogram 1500 unit, as depicted, is $265.60 retail, while the Beovox 2400 loudspeakers retail for $128.43 each.

The Beolit portable radio can be used with the above components as an AM/FM tuner. It is the subject of a separate review. All enquiries regarding B & O equipment should be directed to the sole Australian agents, G.R.D. Instruments Pty. Ltd., 6 Railway Walk, Camberwell, Victoria or their retail outlets. (L.D.S.).

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★ Garrard 3000 Record Changer.
Sonotone 9TAHC Cartridge with Diamond Stylus.

★ Stereo Amplifier:
- Frequency Response, 30Hz to 35KHz ± 2dB.
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- Cross talk —48dB at 1KHz
- Hum and Noise —55dB
- Bass Control, ± 15dB at 40Hz.
- Treble Control, ± 15dB at 14KHz.
- Balance Control.
- Tuner Input.
- Tape Recorder Output.

★ Loudspeakers:
- Frequency Response, 55Hz to 18KHz.
- Power Handling Capacity, 6 watts.
- Bass Unit, 5in High Compliance.
- Treble Unit, 3in Sealed Back.
- Dimensions, 13in x 7in x 8in.

★ Plexiglass Dust Cover and Phased Speaker leads with plugs.

Loudspeakers available separately at $32.00 each.

These are quality instruments made by Klinger Controls Ltd. in England.

Only a limited number is available, so send now to Sole Australian Distributors.

Leroya Industries PTY. LTD.

672 HAY STREET, PERTH, WESTERN AUSTRALIA. 6000.

TRADE ENQUIRIES WELCOME

MULTI-BAND RECEIVER WITH DIRECTION-FINDING

The firm of Nova-Tech Inc., Edgecliff, N.S.W., is offering an imported receiver featuring five bands, including two VHF bands, direction-finding facilities, and a number of other features which make it suitable for professional or semi-professional use.

The main use of the receiver would be in small boats, light aircraft, etc., as a direction finding instrument. For this application it can be used on the low frequency beacon band, the broadcast band, and the high frequency marine band. These three bands operate from a built-in directional aerial, rotatable through 180 degrees over a graduated scale and equipped with sights. The two VHF bands operate from either plug-in collapsible whip aerials or from an external aerial if available.

The low-frequency band covers from 190KHz to 400KHz. This accommodates coastal beacon stations, identified simply by a repeating Morse callsign. With the aid of a copy of the Morse code printed on the aerial housing, even a novice can eventually decipher such a call sign and, assuming the availability of navigational charts showing the location of the beacons, they can be used to establish a "fix."

The broadcast band covers from 550-KHz to 1600KHz and, apart from providing news, weather reports and entertainment, can also be used for direction finding, assuming a knowledge of the broadcast transmitter locations.

The marine band covers from 1.6MHz to 4.5MHz. This covers most of the marine channels allocated in Australia, though not all. One notable exception is the emergency frequency 6280KHz. However, it does cover emergency frequency 2182KHz, small ships, Volunteer Coastal Patrol, trawlers, and similar channels. In addition, it covers the Sydney University channel, the amateur channels on 1.8MHz and 3.5MHz, and sundry utility channels such as bushfire brigades, light aircraft, bushwalkers, flying doctor networks, etc.

There are two VHF bands, obviously intended to cover the communication channels. The lower one covers from 70-MHz to 85MHz, the higher one from 150MHz to 175MHz. A switch is provided to accommodate either AM or FM transmissions. In Australia, these bands cover some TV channels, and the set can be used to receive the sound portion of these TV transmissions. Apart from this, these bands are used mostly for private mobile radio telephone networks by Government departments, taxi companies, and other busines organisations.

While people associated with these systems may find such a receiver useful as a temporary monitoring device, they would seem to offer little to other people except as a means of eavesdropping on private conversations. In this regard it must be emphasised that it is a punishable offence for anyone to reveal the existence of a private message, the contents of such a message, or to make use of the information in any way.

A possible use for these bands, not suggested by the manufacturer, is as a means of tracking down electrical interference caused by appliances, power lines, etc. For various reasons, this is often most easily and accurately performed at VHF. The portable nature of the receiver would lend itself to this application.

A D.F. (direction finding) meter is used to indicate the null in the response when the aerial is pointing in the direction of the station. There is also what appears an RF gain control, the main purpose of which is to control very strong signals and retain the most effective null indication on the DF meter.

The set employs 14 transistors, measures 9in x 6in x 3in, and weighs 2¼lb. It is supplied with a leather carrying case, punched to provide access to the controls (though not the rotatable aerial) and equipped with a pocket to hold the collapsible whip aerials. The case is fitted with a leather shoulder strap. Power is from four penlite (915) internal cells.

The direction-finding aerial is accommodated in the rotatable housing on top of the set proper. It carries a copy of the Morse code and is fitted with folding sights. The vertical rods are the two versions of the VHF aerial.

Alternatively, it may be operated from an external six-volt battery or power supply. The power supply is a separate item, available as an extra, but a suitable plug and cable for use with the external power supply socket is provided. This automatically disconnects the internal batteries when it is plugged in. Two earphone sockets are provided on the front panel, one the older large size, the other the modern miniature variety. An earphone to fit the latter is provided.

Two metal carrying handles are supplied. These may be used as a pair to form a pyramid shape stand or cradle within which the set can be supported on any level surface. Alternatively, one handle may be used in its name role, while the other may be permanently fastened to an appropriate site in a boat or aircraft where it will support the set in a vertical position suitable for direction finding. The handle is fastened to the set with a pair of knurled head machine screws which allow the combination to be clamped together tightly if desired.

Sensitivity figures, for 5mW above noise, are quoted for each band as follows: Low VHF band; 3uV AM or FM. High VHF; 2uV AM or FM. LF (beacon) band; 47uV/M at 300KHz. Broadcast; 35uV/M at 1000KHz. HF (marine); 35uV/M at 3MHz.

In general, the set performs extremely well. The sensitivity appears to be excellent on all bands, but selectivity leaves much to be desired on the VHF bands. It certainly is quite incapable of resolving the crowded state of the bands in our city areas. The VHF bands are equipped with a squelch control, designed to eliminate noise in the absence of a carrier. Unfortunately, it gives a very poor performance by comparison with most squelch controls, seeming to function more as a simple gain control.

Another unfortunate omission is any means of monitoring the condition of the internal batteries which, considering that a meter is already provided, should not have been difficult.

Performance on the main VHF whip aerial is quite good, and its length may be adjusted to approximate the frequency involved. A second VHF aerial system is supplied, consisting of two shorter (two section) telescopic elements. These are intended for mounting in sockets provided at each end of the rotating aerial housing, but the instructions are quite vague as to how they are to be used. It appears that only one socket is connected to the receiver input, the other being merely a physical support. Presumably, the second element is intended to function in a passive role (reflector or director), but no instructions are given in this regard.

Apart from the omission referred to above, the instruction book is well written and contains a complete circuit of the receiver, a diagram showing the location of major components, and a list of all components with values and ratings.

In spite of the criticisms offered, this would appear to be a very good receiver, particularly for anyone needing the direction finding facilities, or the need to monitor marine or aircraft frequencies over and above any facilities already provided in a craft, or where it is felt a complete two-way system is not justified.

Full service facilities are provided by Nova-Tech Inc. through service depots currently operating in Perth, Melbourne, and Sydney. Service depots are planned for Brisbane and Darwin and should be in operation by the time this issue appears.

Price is $139.90, plus 25 per cent sales-tax. Further details may be obtained from Nova Tech Inc., 212 New South Head Rd., Edgecliff, N.S.W., 2027. (P.G.W.)

TURN ON

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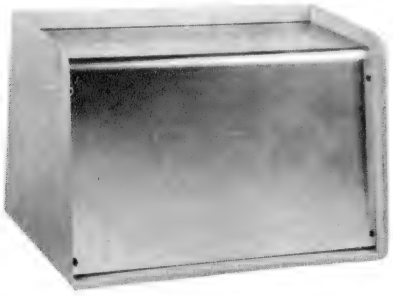
nova-tech, inc.
(Inc. in U.S.A. Limited Liability Company)
212 New South Head Road, EDGECLIFF.
N.S.W. 2027

Trade Inquiries: Lawrence & Hanson Electrical N.S.W., Vic., Qld., S.A., Tas., N.T. Transerve Distributors, W.A.

TRADE RELEASES—IN BRIEF

AUSTRALIAN TRANSISTOR COMPANY, P.O. Box 74, Mount Waverley, Victoria 3149, is manufacturing a new type of instrument case pleasingly styled and suitable for various small projects. It measures 7¼ x 4¼ x 4¼in approx. The main case is made from a tough grey plastic material while the front and top panel is anodised aluminium. The interior has two deep ribs intended to serve as a battery compartment, and the outside of the case is grooved to facilitate handling. Trade price in Victoria is $2.75



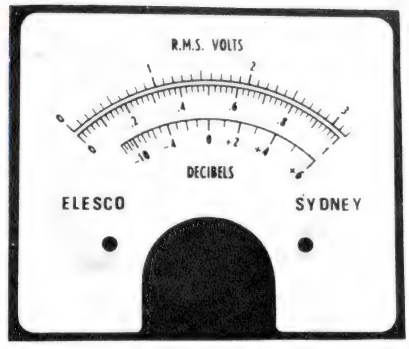
plus tax. We understand arrangements are being made for the marketing of these cases in N.S.W. and other states.

The same company is making a compact signal generator with a range covering 15Hz to 1.5MHz in five continuous bands, output from 0 to 800mV RMS with stepped and fine controls, and distortion less than 0.2 per cent. Two versions are available: Model 100A operates from 240V mains supply; and Model 100B operates from 9V battery. Both units sell for the modest price of $44 plus tax.

R. H. CUNNINGHAM PTY. LTD. have advised that they are Australian distributors for Sennheiser condenser microphones with inbuilt transistorised RF circuitry. A brochure describing the range of Sennheiser microphones is available from the company's head office at 608 Collins Street, Melbourne, Victoria, 3000.

MINIWATT DIVISION of Philips Electrical Pty. Ltd. have introduced a new line of plastic encapsulated mains rectifiers with an average current rating higher than that of any similar device made in Australia. This BY126/BY127 series features a large double-diffused crystal which can deliver an average current of 0.8A each (0.9A at low voltage) into a capacitive filter, and 1A or more if the load is inductive or resistive. The new series is available ex stock from Australian production, with crest working voltage ratings from 50V to 1000V.

We tested samples of these rectifiers, and found them to be completely satisfactory electrically. However, we did find that the type number markings on the samples supplied tended to rub off very easily, and this could be a source of inconvenience in some instances.



Illustrated is a new dial scale prepared by Electronic Supplies, Box 417, P.O., Crown Street, Sydney, for the solid-state signal generator described in our September, 1968 issue. The same company is the supplier for a 50uA meter movement suitable for use in the signal generator, and the new dial scale will save constructors the necessity for calibrating the dial scale themselves.

HEWLETT-PACKARD COMPANY, Palo Alto, California, U.S.A., has released information on a series of transistor chips with guaranteed high frequency characteristics for use in microwave hybrid microcircuits. The chips, HP 35800 series, have typical fTs of 3 to 4GHz and typical fmax as high as 6GHz. Performance of the transistors is specified in s-parameters, and each chip is guaranteed to exceed minimum specifications. A gold contact system has been developed for these chips; this is said to give improved reliability in hybrid microcircuits. Further information may be obtained from the associated Australian company, Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.

NEW KODAK AUDIOVISUAL PRODUCTS

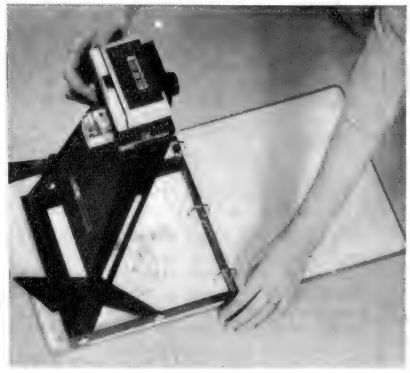
A heavy duty slide projector, a versatile four-speed super-8 movie camera, and an easy-to-operate slide production kit are available from Kodak (Australasia) Pty. Ltd.

The projector is the Kodak Carousel S-AV, which is made in Germany by Kodak AG, and is designed for heavy duty operation in industry, commerce and education. It has a six-pole socket for connecting a remote control unit, interval timer or slide synchroniser, and is supplied with a tungsten-halogen lamp (24V, 250W). The slide carrier is a universal type which takes all forms of currently used slide mounts, and has a capacity of 88 slides. It uses a "drop feed" arrangement which causes the slide to enter the projector by gravity, thus there is no risk of damaging slides by jamming. A thermal cut-out is fitted which operates should the unit overheat.

The super-8 camera, Kodak Ektagraphic 8, features automatic exposure control suitable for films up to 160ASA and is equipped with an extra-fast f/1.8, 9.5 to 45mm zoom lens; a battery powered motor which drives super-8 film at 12, 18, 24 or 32 frames per second; power or manual zooming mechanism; built-in "low-light signal;" bright frame viewfinder which shows the view being recorded for all zoom settings. Normal operation is from three Mallory 88 cells, but an auxiliary battery case provided contains three more cells which can be used in parallel with the internal cells, to give increased life and to facilitate operation in very cold temperatures, when battery efficiency might be affected.

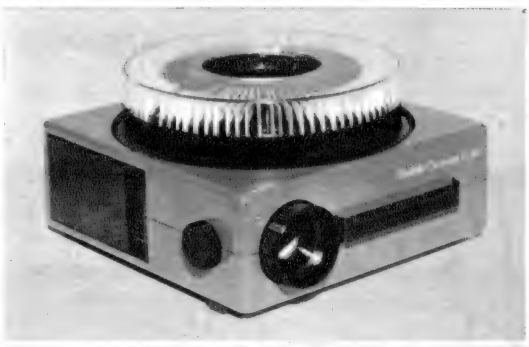
The Kodak Ektagraphic Visualmaker is designed for the production of slide visuals, and is also useful for close-up shots. It consists of a Kodak Instamatic camera and two copy stands fitted with supplementary lenses which automatically compensate focus for areas of 10in sq. and 3in sq. The makers say the equipment will enable anybody to make 2 x 2in slides at an economical cost without photographic skill. Lighting for copying is provided by a flashcube. The Kodak Instamatic camera can be used in the normal manner away from the copying stands.

Further details of any of these items can be obtained from Kodak branches in all capital cities.



Kodak Ektagraphic Visualmaker.

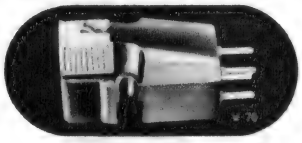
Kodak Ektagraphic 8 Camera.



Kodak Carousel S-AV heavy duty slide projector

NEAT man—That's the way to enjoy Hi-Fi Music

CARTRIDGES



V70 MOVING MAGNET CARTRIDGE.
*** Review from Hi Fi News available.**
The V70 is a top performance—high quality magnetic cartridge that out-performs many more expensive cartridges.

Specifications—Output voltage: 5mV 1,000 c/s 5 cm/sec. Frequency range: 20-20,000 c/s. Channel balance: ± 0.5 db 1,000 c/s. Channel isolation: 30 db 1,000 c/s. Compliance: 5.0 × 10^{-6} cm/dyne. D.C. resistance: 800 Ω. Load resistance: 50K Ω. Playing weight: 1.5 gr.-3 gr. Stylus: 0.5 mil diamond.

V60 Induced Magnet Cartridge.
Specifications — Output voltage: 4 mV. Freq. range: 5-30,000 c/s. Channel isolation: 30 db. Compliance: 6 x 10^{-6} cm/dyne. Stylus: 0.7 mil. diamond. 0.2 x 0.8 mil. for Model V-60E.

V15 "Dynamagnet" Cartridge.
Specifications — Output voltage: 5 mV. Freq. range: 20-21,000 cps. Cross talk: 30db at 1,000 cps. Stylus: 0.7 mil. diamond. 0.2 x 0.8 mil. for Model V-15E.

NEAT TONE ARMS

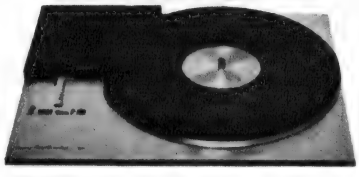
G-32 "Gyrostat" Professional Tone Arm.

This professional Tone Arm is a beautifully engineered instrument featuring the revolutionary "GYROSTAT" rotary mechanism. Designed for milligram tracking and as for all NEAT tone arms, will accept all standard ½in monuting cartridges, including Ortophon and SME hearshells without modification

G-30 Static Balance Tone Arm
* Review from "GRAMAPHONE" available.

The NEAT G30 Static Balance Tone Arm is a high quality—low priced Hi-Fi tone arm, of which the conception, construction and finish are equal to many tone arms selling at considerably higher prices. When used with the NEAT V70 cartridge, an excellent low cost combination can be obtained.
Other outstanding NEAT tone arms available are the G37 Static balance tone arm, and the G36 Professional tone arm.

NEAT PROFESSIONAL TURNTABLES



NEAT P100 Professional Belt Driven Turntable. A precision built transcription turntable built to instrument standards of quality and appearance.

Specifications: • Phonomotor: Condenser phase advance 4-pole synchronous motor. • Turntable: Aluminium alloy disc of 30 cm in diameter, of 2.5 kg. • Voltage 240 V. • Power consumption: 15 W. • SN ratio: over 50 db. • Wow: under 0.1%. • Dimensions: 400 x 325 x 125 mm.
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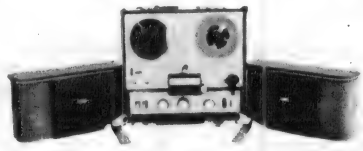
JANUARY SPECIALS



Sony TC-200B. Vertical or Horizontal Operation.
Hi Fi Stereo Tape Recorder.
Features • Complete 4 track stereo and mono tape recording and playback system. • Sound on Sound recording. • Two complete full range satellite speaker systems. • Individual VU meter and volume controls for each channel. • Light weight (only 27 lbs.). • Two Sony high quality dynamic microphones. • Compact carry case beautifully styled in black and ivory decor.
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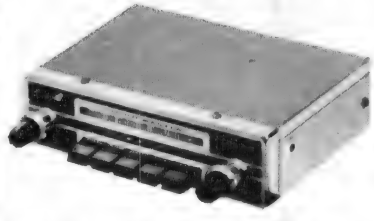
CAR RADIO SPECIAL SOUNDMASTER 8



The new super sensitive push button all transistor car radio, featuring 8 trans.—3 W. output—push button tuning—built-in noise suppression—high quality speaker—suit any car—Truscott's price only **$55.00**
If aerial required add **$4.00.**

COMBINATION SPECIALS FOR JANUARY

Kenwood TK 2OU Stereo Amplifier with AM-FM tuners—Dual 1010F Deluxe Turntable with Neat V70 Magnetic Cartridge—2 Kenwood S102U Speaker systems. **$373**
With JH Turntable, Neat G30 Tone Arm and V70 cartridge in lieu of Dual 1010F. **$357**

Kenwood TK 150U Stereo Amplifier—JH Turntable, Neat G30 Tone Arm and Neat V15 Mag. cartridge—2 Kenwood S102U Speaker systems. **$279**

Leak Stereo 30 Amplifier—Dual 1009F Turntable with Neat V15 Mag. cartridge—2 Leak Mini-Sandwich speaker systems. **$464**

With Dual 1015F Turntable and V15 cartridge in lieu of 1009F. **$451**

Kenwood TK 250U Stereo Amplifier—Dual 1019 Turntable with Neat V60 Mag. cartridge—2 Kenwood KL60 Speaker systems. **$565**

With Dual 1009F Turntable and V60 cartridge in lieu of 1019. **$536**

NEAT HI-FI EQUIPMENT

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Interstate outlets:
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HEWLETT-PACKARD AUSTRALIA PTY. LTD. announces that Mr John A. Warmington, director and general manager of the company, left Melbourne in December to confer with executives of the parent company at Corporate Headquarters, Palo Alto, California, U.S.A., and to discuss plans for future development of the Hewlett-Packard organisation in Australia and New Zealand. He will visit most of the 12 manufacturing divisions throughout the U.S.A. and the United Kingdom and will confer with marketing personnel within the Canadian and U.K. marketing organisations before returning to Melbourne in February.

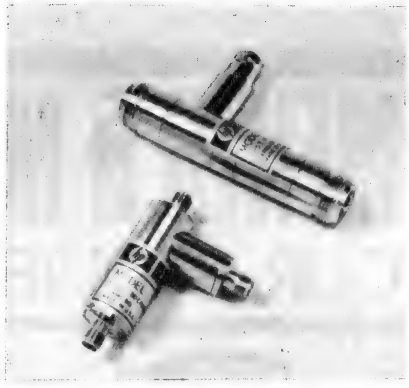
PLESSEY ELECTRONICS has appointed Mr John Dearn as sales manager of its Vinten Division, which manufactures mobile radiotelephone equipment. Prior to joining Plessey, Mr Dearn was Victorian manager of Philips Telecommunications of Australia Ltd.

INFORMATION ELECTRONICS LTD., a new company formed to produce the IE 10,000 computer, based on the design of the Intergraphic Computer recently completed by a research team at the University of N.S.W., plans to begin production in Canberra this month. The company has obtained the sole world rights to manufacture the IE 10,000 computer, and market it commercially, from Unisearch Ltd., the research and development company of the University of N.S.W. Sydney Stock Exchange recently approved listing of Information Electronics shares on the Exchange.

PHILIPS ELECTRICAL PTY. LTD. have advised that many cars taking part in the London-Sydney Marathon were equipped with Philips EL 3303 cassette recorders to enable them to make daily reports on their progress. Car crews handed in their tapes as they checked in at control points along the route. The cassettes were immediately transcribed on the spot for reporters covering the race to enable them to send stories back to Sydney or London or flown to Australia for the use of radio stations.

Organisers of the Marathon decided to equip crews with the recorders and cassettes, capable of recording for two hours, after discussion with executives of Philips Electrical Pty. Ltd. The Sydney base of the organisers was also equipped with EL 3302 cassette recorders for replay of all tapes received by air. Some car crews took musicassettes with them for entertainment during the long drive.

HEWLETT-PACKARD in the U.S.A. has introduced a range of ready-made custom-designed microwave diode switches. These solid-state coaxial switches are available in 56 combinations, with octave ranges between 1 and 18GHz, maximum attenuation levels of 40, 60 or 80dB and various connector styles. Switches are assembled from off-the-shelf parts, making it possible to tailor the switches to meet particular requirements quickly and at low cost.



Two examples of the Hewlett-Packard custom-designed microwave diode switches.

The switches are P-I-N diode reflective types in an SPST configuration. Biasing the diodes in the reverse direction allows RF power to pass. When forward biased, the diodes shunt the line with a very low impedance, reflecting most of the power back up the line. They are useful as attenuators, levellers, pulse modulators, T-R switches, and in other low-power applications where fast switching time (as fast as 10 nanoseconds) is needed.

Inquiries should be addressed to Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Victoria, 3146.

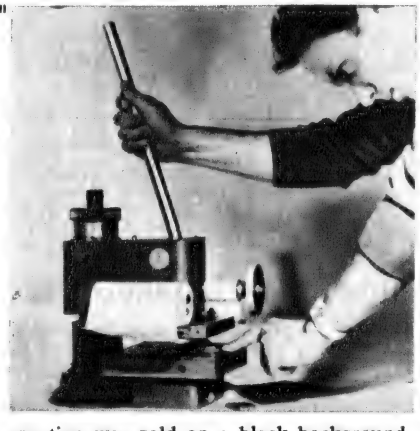
TEXTRONIX AUSTRALIA PTY. LTD. has moved to a new address, located at 80 Waterloo Road, North Ryde, N.S.W. 2113. The company was previously at Foster Street, Sydney.

STANDARD TELEPHONES AND CABLES PTY. LTD. has won a contract worth $1.2 million for extensions to the Army's automatic message switching system known as STRAD (Signal Transmission Reception and Distribution). The contract, let by the Department of Supply, will increase the capacity of STRAD to meet the Army's requirements for the next ten years. STRAD can receive and send a thousand messages within a few minutes without manual operation. Messages are automatically grouped according to addresses, priorities and security classifications. It is estimated that STRAD saves a minute per message, and as the Army sends thousands of messages each day through a complex network in Australia and to overseas outlets, enormous time saving is achieved.

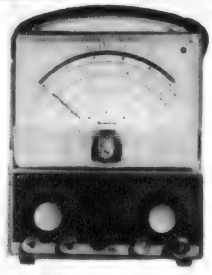
Compact Ticket Maker

LETRASET AUSTRALIA PTY. LTD., 230a Sussex Street, Sydney are marketing in Australia a new type of ticketing machine, the Masseeley Minor. This is a compact unit capable of producing within seconds attractive cards with lettering comparable to top-quality printing. The machine is available with all necessary accessories as a complete package. The accessories comprise type in various sizes, card in white and blue, coloured foil, and a guillotine for cutting the card to the desired size.

To make a ticket, the message is set up in type and placed in the machine, the card is cut and positioned, the foil is placed between the type and card, and the operating lever is pulled. The foil is available in a range of colours, including gold. A sample ticket sent to us for inspection was gold on a black background, and was most attractive and professional in appearance.



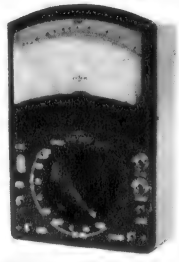
INSTRUMENTS & METERS
TO SUIT YOUR REQUIREMENTS



KEW 142 V.T.V.M.

AC and DC voltages 0 to 1.5, 5, 15, 50, 150, 500, 1500
Decibels (dbm) - 20 to + 65 db
Resistance 0 to 1K, 10K, 100K, 1M 10M, 100M, 1000M
Accuracy ± 3% of scale length
Input Impedance 1.4 M ohms AC range, 11 M ohms DC range
Response (AC volts) 30 Hz to 500 KHz ±3db, 20 Hz - 10MHz ± 10db

Price $59 inc. tax Postage 70c



CT 330 MULTIMETER

DC Voltage Ranges 0 - 0.6, 6.0, 30, 120, 600, 1200, 3000, 6000
AC Voltage Ranges 0 - .6, 30, 120, 600, 1200
DC Current 0 - 0.06 mA, 6, 60, 600 mA
Resistance 0 - 6K, 600K, 6M, 60M
Capacitance 50 pF to 0.01 MFD, 1000 pF to 0.2 MFD
Decibels - 20 to + 63db
Sensitivity DC 20,000 ohms per volt, AC 10,000 ohms/volt

$15.95 inc. tax Postage 50c

200H MULTIMETER

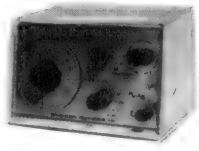
DC Voltage Ranges 0 - 5, 25, 50, 250, 500, 2500
AC Voltage Ranges 0 - 10, 50, 100, 500, 1000
DC Current 0 - 5-uA, 2.5 mA, 250 mA
Resistance 0 - 6K, 6M
Capacitance 10pF to 1000pF, 1000pF, 0.1 mFD
Decibels - 20db to + 22db
Sensitivity DC 20,000 ohms per volt AC, 10,000 ohms/volt

$11.95 inc. tax Postage 50c

CT - 500/P MULTIMETER

DC Voltage Ranges 0 - 2.5, 10, 50, 250, 500, 5000
AC Voltage Ranges 0 - 10, 50, 250, 500, 1000
DC Current 0 - 0.05 mA, 5 mA, 50 mA, 500 mA
Resistance 0 - 12K, 120K, 1.2M, 12M
Decibels - 20 to + 62db
Sensitivity DC 20,000 ohms per volt, AC 10,000 ohms/volt

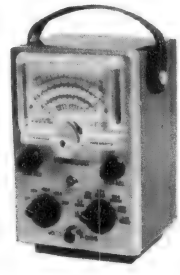
$17.38 inc. tax Postage 50c



SOLID STATE AUDIO SIGNAL GENERATOR.

Available as battery or AC operation
Ranges - 15Hz to 1.5 MHz in 5 ranges
Output - 800 mV (2.5V p-p) max. Adjustable in 5 steps with fine control

1008 (Battery) $50.60 inc. tax
100A (AC) $57.50 80c postage



FERROCART PV 33 V.T.V.M.

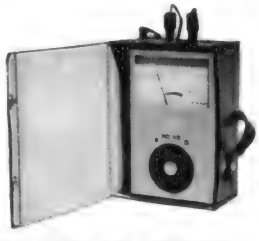
AC and DC voltages 0 - 1.5, 5, 15, 50, 150, 500, 1500
Decibels - 10 to + 65 db
Resistance 0 - 1K, 10K, 100K, 1M 10M, 100M, 1000M
Input Impedance 11 M ohms DC range
Response (AC Volts) 30Hz to 100KHz
Special Price Limited Stock only

$45 inc. tax Post Free

KEW 33 MULTIMETER

AC & DC Voltage Ranges 0 - 10, 50 250, 500, 1000
DC Current 0 - 0.05 mA, 10mA, 250 mA
Resistance 0 - 20K, 200K, 2M
Decibels - 20 to + 22db
Sensitivity DC 20,000 ohms per volt, AC 10,000 ohms/volt

$16.70 inc. tax Postage 50c



NEW EVERSHED MEGGER

Range - 0.1 ohm to 200 Megohms in 3 ranges

Has in-built battery tester, stable voltage generator and the famous Evershed & Vignoles cross-coil ohmeter movement. In attractive leather case with probes

$62.70 inc. tax Postage 70c

LEADER LSG 11 RF SIGNAL GENERATOR

Ranges - 120 KHz to 130 MHz in 6 Band (Fundamentals) Calibrated Harmonics from 120 MHz to 390 MHz
Internal Modulation 400 Hz & 1000 Hz with provision for Xtal & EXT signals
RF Output - 0.1 mV, 120 HKz to 38 MHz

$39.10 Postage $1

COME AND SEE US IN OUR NEW SHOWROOM.

GENERAL ACCESSORIES

SPECIALISTS IN ALL INSTRUMENTS AND MEASURING EQUIPMENT.
153 STURT STREET, SOUTH MELBOURNE, VICTORIA. PHONE 690.300.
ALSO AVAILABLE IN ALL OTHER STATES.

Pictured is the new Weston LM501 25W amplitude modulated transceiver, which is all-solid-state except for two valves in the transmitter. FETs and ICs are used in the receiver, while the transmitter modulator and power supply are both solid-state. A feature of the LM501 is a new type of muting using an IC. This eliminates the transient "plop" caused by the opening and closing of the muting by a received signal and is not subject to "muting flutter" caused to weak signals by multi-path interference. (Weston Electronics Pty. Ltd., 376 Eastern Valley Way, Roseville, N.S.W.)

RCA OF AUSTRALIA PTY. LTD. has had discussions with Mr J. E. Harrison, vice-president and chief engineer of RF Communications Inc., U.S.A., concerning the local manufacture of the American company's RF communications transmitters. RF Communications, based in Rochester, New York, was formed in 1961 by four engineers and has expanded steadily since, until now its staff numbers more than 750 employees. It now claims to be one of the foremost suppliers of single-sideband transmitters in the western world, and is engaged in systems work for the U.S. Navy and the design and fabrication of complete communications controls for the U.S. Armed Forces. Currently it is producing radio transmitters and ancillary equipment for the Navies of Australia, U.S.A., Canada, Spain and Venezuela.

STANDARD TELEPHONES AND CABLES PTY. LTD. has won a three year contract to supply the Posts and Telegraphs Department of the Territory of Papua and New Guinea with four different types of fixed log-periodic aerials for the transmission of telephone and telegraph traffic. Designed to alleviate tropical HF path problems, the aerials will be used to beam HF trunk communications to some of the remote island locations of New Guinea, and also between mainland points of the Territory. The wideband log-periodic fixed-type aerials are designed and erected to operate in one chosen direction, and vastly reduce the required ground area compared with a rhombic aerial.

PLESSEY ELECTRONICS GROUP, in the U.K., has developed a combined UHF/VHF airborne transceiver to be used by the British Armed Services. Known as the PTR 377, it has been specified as standard equipment for the Jaguar and Harrier aircraft, and the Anglo - French helicopters. It operates over the 100-156-MHz VHF band and the 225-400MHz UHF band, and provides radiotelephone communication on AM, data transmission on FSK, and homing in azimuth at both VHF and UHF. If required, it can be adapted to RT operation on FM. Only silicon semiconductor devices have been used to give a wide environmental range and high reliability. Integrated circuits are used extensively, and practically all moving parts have been eliminated.

NATIONAL SEMICONDUCTOR has released a family of inexpensive amplifiers containing separate controls and amplification functions which allow for adding squelch, voice - operated transmit-receive (VOX), automatic audio gain control, or speech compression, to transceivers, intercom systems, or tape recorders. Known as LM370, the temperature range is from 0 to 70 degrees C, the DC output shift is —1000mV to +1000mV with a power supply of 12V and a drain of 12mA. The input bias current is 16mA, while the voltage gain is 35dB. For further information, contact Rutherford Electronics Pty. Ltd., 833 Doncaster Road, Vic., 3108.

SATO PARTS CO. LTD. has added a new terminal to its range. Known as type T-4 US, it uses ABS resin insulation (in black or red) and may be fitted to panels up to 5mm thick. It is fitted with a specially designed bush, and comes complete with a lug terminal for wiring. The terminal has a socket for a banana plug in the captive head, and a side socket for wire or pins. Inquiries to the company at 2-12 Ebisu, Shibuya, Tokyo, Japan.

VARIAN LEL DIVISION has introduced a new series of octave band low-noise solid-state preamplifiers. Frequency range is 1.0 to 2.0GHz, with minimum gain of 25dB and a typical noise figure of 5.0dB. The OTX-1-1000 preamplifiers feature lowest achievable noise figure commensurate with high input and output power handling capability. Modular microstrip construction and all solid state components provide high reliability and uniform performance. Inquiries to the Australian associated company, Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W. 2065.

MULFORD PLASTICS PTY. LTD. is distributing glass fabric in Australia for industrial purposes. The fabric, made by Burlington Industries of the U.S.A., is used for reinforcing plastic body armour worn by U.S. Marines in Vietnam. The glass fabric is used industrially in such applications as printed circuits, electrical insulation, boat hulls, ship superstructures, firefighting suits, filtering pads for dust collection bags in large industrial plants. Inquiries to Mulford Plastics Pty. Ltd., P.O. Box 71, Rozelle, N.S.W. 2039.

VARIAN VACUUM DIVISION, Palo Alto, California, U.S.A., has revised its production and testing procedures for high-voltage and high-and-medium-current vacuum electrical feedthroughs. A new ceramic mix, high-temperature glaze and metallising formula have nearly doubled the tensile strength. Precision brazing under calibrated oven temperatures ensures strict uniformity. Acceptance tests include helium leak-checking, "high-potting," visual and dimensional screening, and destructive tensile testing of representative samples. Data sheets of Varian feedthroughs are available on request. Inquiries to Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W. 2065. ■

RADIO HOUSE PTY. LTD.

306-308 PITT STREET, 6 ROYAL ARCADE & 760 GEORGE STREET, SYDNEY

NEW FROM GERMANY

THE OXFORD CORDLESS ELECTRIC RAZOR

Battery Operated

Twin blades rotary cutting head, spare batteries. **15c**
Size 5in x 1½in.

Posted $8.75

CHROME VAN

German screwdriver and pocket tester.

1. 6-12 volt model auto test.
2. Sparkplug tester.
3. 110-380 volt mains tester.

$1.25 each

Actual Size

"KEYLITE" $3.95

Free. One spare mercury cell.

With fob keyring, attractive gold finish case. Simply squeeze. Illuminates car and house locks, etc.

$4.00 Posted anywhere

Cordless battery-operated Electric scissors cuts all materials fast and clean. 1 torch cell fits in handle, complete posted. **$4.95**

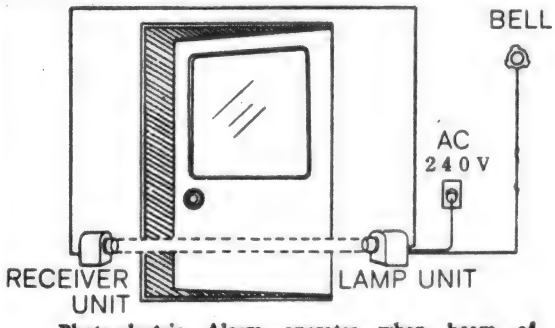


Photo-electric Alarm operates when beam of light across entrance, 20-50 ft., maximum, is broken by intruder. No wires or moving parts. This magic eye can be connected to a bell or light to announce the entrance of visitors, etc. 240 V. mains required.

$39.00 or $40.00 posted.

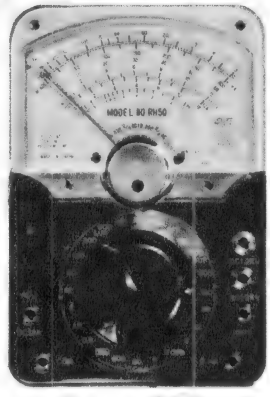
MULTIMETER TESTERS

Model RH-50

Modern Design, 33 Micro-Amp Meter.
30,000 Ohms per Volt D.C.
13,000 Ohms per volt A.C.
1 p.c. Multipliers and Shunts used.
Printed circuit.
Clear Scale, rugged moulded case.

SPECIFICATIONS:

DC VOLTAGES: 0-0.25-1-2.5-10-25-100-250-500-1,000 V at 30,000 ohms per volt.
AC VOLTAGES: 0-2.5-10-25-100-250-500-1,000 V at 15,000 ohms per volt.
DC CURRENTS: 0.05-5-50-500 mA, 0-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: Minus 20 to plus 56 dB (0 dB equals 1 mW, 600 Ohms).
Audio Out: Capacitor in series with AC Volt ranges.
Short Test: Internal buzzer.



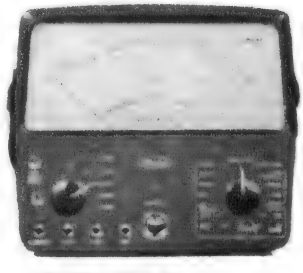
Price $31

With leather case, **$38.00.** Postage 50c to $1 extra.

Accessory: 1 pr. heavy test leads.
Batteries: 1 (1.5V), 1 (15V).
Size: 3 5/16" x 6 5/16" x 2¾".
Weight: 1.4lb approx.

NEW MODEL A-10 MULTIMETER AND SIGNAL INJECTOR

With Test Leads and Injector Probe



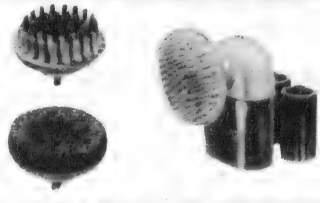
30,000 O.P.V.

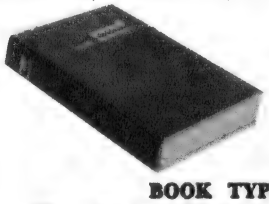
SPECIFICATION: 6in x 2½in scale.
DC Voltage: 0-0.5, 2.5, 10, 50, 250, 500, 1,000 V at 30,000 o.p.v. 5,000 and 25,000 V at 10,000 o.p.v.
AC Voltage: 0-2.5, 10, 50, 250, 500, 1,000 V at 10,000 o.p.v.
Volume Level in Decibels.
DC Current: 0-50 uA, 1, 50, 250 mA, 0-1 and 10 amps.
AC Current: 0-1, and 10 amps.
Resistance: 0-10K, 100K, 1M, 100 Megohms. Signal Injector Output Jack. Zener Diode Overload Protection.

Price $54.00

"RIAM" Swiss-made battery-operated Vibratory Massager comes complete with two batteries, three applicators and instruction sheet.

$8.50 or $9.00 posted.





XMAS SPECIAL

$19.95

BOOK TYPE

The latest model portable Tape-recorder. 4 transistor, 3in Reels, 2 track. Instruction manual. Size 10½in x 7in x 1½in.
Just open the book and record. Supplied complete with tape, microphone and batteries. Special discount price:

$19.95 posted anywhere.

"CONION" transistorised SIREN ALARM can be used for personal protection or as a burglar alarm. Loud siren sounds for 20 minutes when cord is disturbed. Pocket size, easily concealed.

$11.75 complete. Posted, $12.00.

PORTABLE PLAYS 33 x 45 RECORDS

SIZE 9½" x 5½"

ALL TRANSISTOR RADIO
Phonograph. Complete
$45.00

NEW R H 1969

(RADIO HOUSE)

RANGE OF

MULTIMETERS

Features:
High sensitivity, minimizes the loading effect to the circuit under test.
Wide coverage of measuring ranges.
Clear, plastic dial covering for easy and accurate measuring

- **Double-jewelled ±2% meter**
- **±1% temperature-stabilized film resistors.**

MODEL SK-80

20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts. 0.5, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current: 50uA, 5mA, 50 mA, 500 mA

Resistance. 5 kΩ, 50kΩ, 500kΩ, 5 MegΩ

Decibels. +10 −62lb.

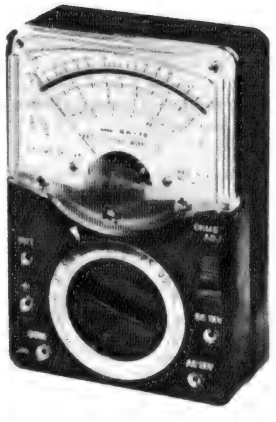
Accuracy. DC±3%, AC ±4% (of full scale)

Batteries. Two 1.5V dry cells. Size AA, "Eveready" 915

● Overload-protected by dual silicon diodes. ● Mirror scale.

$18.00 ***Postage 50c.***

MODEL SK-70



30,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts. 0.5, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current. 50 uA, 5 mA, 50 mA, 500mA

Resistance: 7 kΩ, 70 kΩ, 700 kΩ, 7 MegΩ

Decibels. −10 +62 db

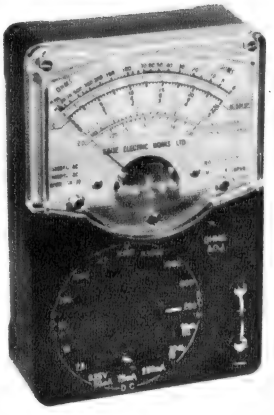
Accuracy. DC±3%, AC± 4% (of full scale)

Batteries. Two 1.5 V dry cells. Size AA, "Eveready" 915

● Overload-protected by dual silicon diodes. ● Mirror scale.

$22.50 ***Postage 50c.***

MODEL SK-20



20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts: 0.25, 2.5, 10, 50, 250, 1000 (20,000/V)

AC Volts: 10, 50, 250, 500, 1000 (10,000/V)

DC Current. 50 uA, 25mA, 250mA

Resistance. 7kΩ, 700kΩ, 7MΩ

Decibels. −10 +22 (at AC/10V) +20 +36 (at AC/50V). Upper frequency limit 7kc.

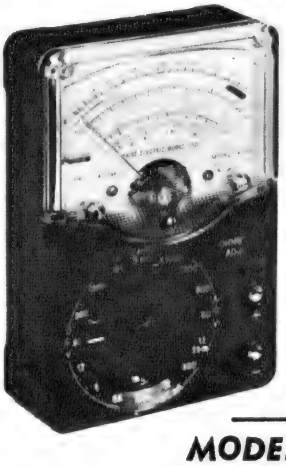
Accuracy. DC ±3%, AC ±4% (of full scale)

Batteries: Two 1.5V dry cells. Size AA, "Eveready" 915

● 16 Positions heavy duty switch.

$13.95 ***Postage 50c.***

MODEL SK-55



30,000 Ohms per Volt DC
14,000 Ohms per Volt AC

SPECIFICATIONS:

*DC Volts: 0.6, 3V, 12V, 60V, 300V, 1200V (30,000 ohms/V).

*AC Volts: 12V, 60V, 300V, 1200V (14,000 ohms/V).

*DC Current: 60 A, 12mA, 300mA.

*Resistance: 10K ohm, 1Meg ohm, 10Meg ohm.

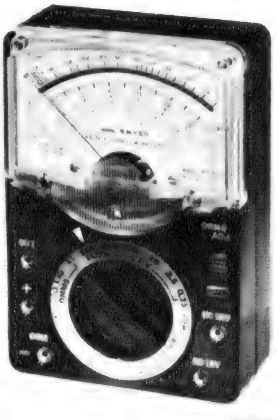
*Decibels: −10db +23db.

*Meter Sensitivity: 23 A.

● Overload-protected by dual silicon diodes. ● Mirror scale.

$20.00 ***Postage 50c.***

MODEL SK-60



50,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current. 25 uA, 5 mA, 50 mA, 500 mA

Resistance: 10 kΩ, 100 kΩ, 1 MegΩ, 10 MegΩ

Decibels. −10 +62 db

Accuracy: DC±3%, AC± 4% (of full scale)

Batteries. Two 1.5 V dry cells. Size AA, "Eveready" 915

● Overload-protected by dual silicon diodes. ● Mirror scale.

$25.00 ***Postage 50c.***

NOTICE

The 6-8 Royal Arcade address will close down in February 69 during the re-building of the Arcade.

RADIO HOUSE PTY. LTD.

306-308 PITT STREET: 6, ROYAL ARCADE & 760 GEORGE STREET, SYDNEY

Electronic Technicians Earn Big Money!

Why not YOU?

With training through T.T.I., you could qualify for a start in the Electronics Industry as a:

• Radio-television technician • Telecommunications technician • Instrumentation technician • Business machine technician • Automatic control technician • Industrial electronic technician—and many other skilled positions.

WILL YOU FILL THE BILL WHEN THE TIME COMES?
The "good job" you hold down today may offer less and less opportunity for advancement as Electronics increase their impact on all branches of industry.

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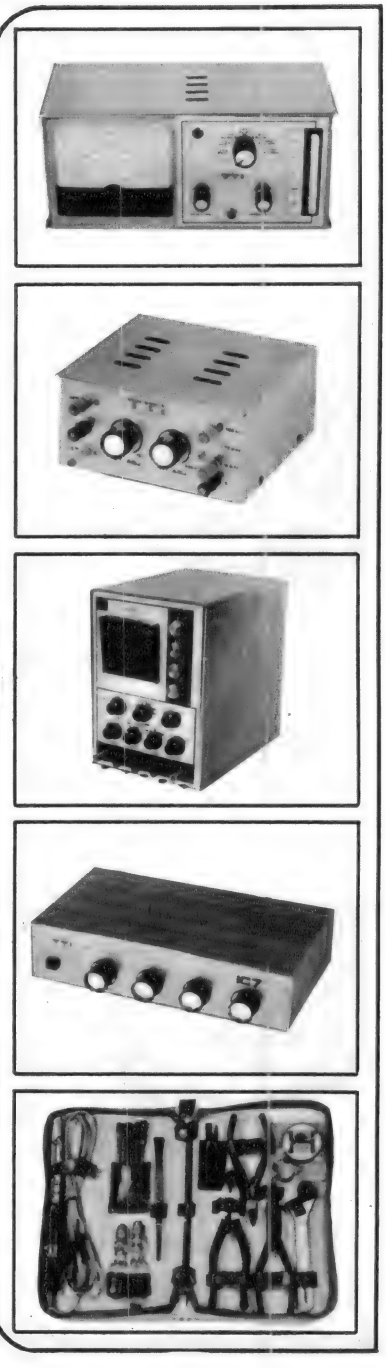

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TECHNICAL BOOKS AND PUBLICATIONS

Amplifiers, Oscillators

FEEDBACK AMPLIFIERS AND OSCILLATORS, by Robert E Sentz and Robert A. Bartkowiak. Published by Holt, Rinehart and Winston, Inc., New York. Soft Covers, 218 pages, 9in x 6in. Illustrated with line drawings, graphs, circuits etc. Price in Australia $4.35, post free.

This is an up-to-date treatment, in some depth, of the applications of feedback, both positive and negative. As such it deals with two phases of electronics which, superficially, may appear to have little in common, i.e., amplifiers and oscillators. However, the authors adopt the more fundamental approach, essential to a proper analysis of circuit behaviour, of treating oscillators as amplifiers with positive feedback.

An idea of the book's intended role can best be gained by quoting from the preface. "This text is . . .designed for use in technical institutes, and junior and community colleges.... also as a text in industrial training programs for upgrading currently employed technicians, and in independent self study programs.

"The principle objective is to discuss the application of active devices connected as feedback amplifiers. Both negative feedback and positive feedback. . . are discussed.

"The assumed prerequisites are as follows: (1) A course in DC and AC circuits, including network theorems; (2) an understanding of basic electron devices (transistor and tube) used as single stage and multistage voltage and power amplifiers; (3) the methods of interstage coupling and their effect on gain and frequency bandwidths; and (4) a working knowledge of algebra and trigonometry."

The chapter titles are as follows: (1) Fundamental Types of Feedback. (2) Single Stage Feedback Amplifiers. (3) Stability, Phase Shift and Frequency Response. (4) The Simple Oscillatory Circuit and Four Terminal LC Oscillators. (5) Crystal Oscillators. (6) Negative Resistance Oscillators. (7) RC Phase Shift Oscillators. (8) UHF and Microwave Oscillators.

Questions and problems based on the text are given at the end of each chapter, and a representative number of answers to the problems, for checking purposes, are given in the appendix.

While some portions of the text may be useful at lesser levels, we must emphasise that this book is directed to those people who are equipped, mathematically, to handle it. Most of the discussions, and particularly the analyses of circuit operation and behaviour, employ a mathematical approach — the only worthwhile one for the serious student.

For either the student pursuing a course of study, or the engineer who desires a comprehensive reference on this subject, this would appear to be an excellent book.

Our copy from Holt, Rinehart and Winston (Aust.) Pty. Ltd., 79 Whiting Street, Artarmon, N.S.W. 2064. (P.G.W.)

Transistor circuits

104 EASY TRANSISTOR PROJECTS YOU CAN BUILD. By Robert M. Brown. Published by Tab Books, Blue Ridge Summit. Pa, U.S.A. Soft Covers, 223 pages, 5½in x 8½in. Illustrated with numerous circuit diagrams. Price in U.S.A. $3.95. (Hard-cover $6.95).

Books of this type appear to be passing through a minor boom at the present time; one by the same author was reviewed recently (December, 1968), while another is reviewed elsewhere in these pages. They are simply a selection of circuits, covering a wide range of relatively simple projects, and presented with a bare minimum of accompanying text. The circuits range from the essentially gimmicky, like "idiot boxes" and "beeper boxes" to quite practical ones, such as battery chargers, code practice oscillators, and a large number of gadgets which will appeal to the amateur.

No constructional details are given, but this is not a serious omission for the majority of such simple circuits. And, unlike the book reviewed in the December issue, the author does make an attempt to describe the circuit function. Even where this has not been done as thoroughly as some might like, there is at least a complete circuit which one can study and evaluate.

Unfortunately, much of the text is not merely inadequate; it is downright misleading. For example, project 51 (page 105) describes a VFO, which it claims to be more stable than any which can be bought, **because** it operates at 25MHz rather than 8MHz, and therefore errors and drift are not multiplied by following multiplier stages. This completely ignores the fact that frequency drift is proportional to frequency and may even be harder to avoid as the fundamental frequency is raised.

Project 61 (page 128) an Electronic Fence Charger, takes more risks with safety than we would care to accept. Using a standard ignition coil connected virtually to the AC mains it takes no account of the possible consequences of a breakdown between primary and secondary; a situation which could connect the active mains lead to the bare "fence" wire. Considering the nature of the circuit, the pulse it would generate would almost certainly be well in excess of the voltage rating between the transformer windings, making the risk of breakdown a very real one.

Project 97 (page 200) describes a Tunnel Diode 100KHz Generator. The author claims that "... almost without exception this circuit stacks up to the best of the crystal types . . .(a highly suspect statement anyway, which he then qualifies) "... except that variations in temperature will affect frequency somewhat."

Project 102 (page 210) describes a trickle charger for a nickel-cadmium cells in a VTVM. The idea is a good one, but the author completely ignores the charge rate requirements dictated by different sizes of cell. The values given may result in a completely inadequate charge for larger cells, or may be dangerously high for very small cells.

And Project 83 (page 170), a Flashlight Battery Rejuvenator, must surely take top marks for inaccuracy. There are so many garbled statements that one hardly knows where to begin. First, the author implies that cells can be rejuvenated after they "go dead." In fact if rejuvenation is to be successful it must be undertaken early in the discharge cycle. Even more puzzling is his warning that the circuit is suitable only for a 1.5 volt cell and that bigger cells cannot be accommodated. In fact, the circuit is a constant current arrangement and would charge one cell, or a dozen in series, at essentially the same rate. Also, the use of a 15 amp fuse, in a circuit which automatically limits the current to a few milliamps, seems rather pointless.

The author also talks about the relative merits of recharging with AC and DC, a distinction which is new to this reviewer (and the rest of the E.A. staff). However, even assuming that the distinction is valid, the claim that the **normal** life of a cell, under a certain load, can be increased from 4½ minutes to several hours, simply by charging it with DC, can only be regarded as rubbish.

The best that one can say about this book is that many of the ideas it contains are good ones and, assuming the reader has the necessary technical background to sort the wheat from the chaff, it could therefore provide some useful circuits as a guide. In the hands of the inexperienced, however, it could lead to waste of money, disappointment and, in odd cases, a possible hazard.

In any case, the Australian reader should consider that many of the components, particularly transistors, may not be readily available on the local market. Substitutes would have to be found, if the reader feels confident to tackle this problem, or the project ignored.

In all the circumstances: Not particularly recommended. Our copy direct from the publishers. (P.G.W.)

Circuit guidebook

TRANSISTOR CIRCUIT GUIDEBOOK, by Byron Wels. Published by Tab Books, Blue Ridge Summit, Pa., U.S.A. Soft covers, 219 pages, 8½in x 5½in. Illustrated with numerous circuit diagrams. U.S. price, $4.95 (Hard covers, $6.95).

This is another of the books aimed at presenting a multitude of typical solid state circuits, designed to perform a wide variety of functions. As with those reviewed elsewhere and in a previous issue (December 1968), this one presents a large number of circuits and parts lists, with a bare minimum of text. As such, it is suited to the more experienced experimenter than the absolute beginner.

A major difference between this book and the two previous ones is that the circuits in this case come from a number of well-known organisations: Texas Instruments, Radio Shack, RCA, Motorola, and Microwave Associates, to name those credited in the introduction. As a result, one could reasonably expect that the designs are based on sound engineering principles, an impression which is confirmed by a closer study of a representative sample.

A further advantage from the reader's point of view, is that the book is divided into logical sections, each devoted to circuits of a particular device. Thus, we have Tuner and Receiver Circuits, Amplifier Circuits, Test Equipment, Power Controlling Circuits, Light Controlling Circuits, Transmitter Circuits, Special Audio Circuits, Special Receiver Circuits, Automotive Accessories, Differential, Integrated, and Counter Circuits, Experimental Circuits, Converter-Inverter Circuits, and Television Circuits. Some of the sections contain a dozen or more circuits, a few contain only two or three.

The TV Circuits section contains the full circuit and parts list of a solid state colour TV receiver, but we doubt whether the author seriously intended this as a constructional project, since it would be virtually impossible to construct such a complex piece of equipment from such limited information. On the other hand, it is an interesting example of the current state of the art.

It would be impossible to list all the projects, but they range from an RF booster for a SW set to a theramin, from an emergency marine transmitter to a 60W

PA amplifier, from a ring counter to a dip oscillator.

As with other books of this type, the Australian reader must be prepared to find that some of the solid state and other components may not be available on the Australian market. How serious this may be depends on how adept the individual is in adapting what is available to suit the circuit.

Summing up, we would say that this is a much more successful attempt at this kind of book than others we have seen recently. If you have a need for one, this would seem to be the logical choice.

Our copy direct from the publishers. (P.G.W.)

Amplifier stages

VOLTAGE AND POWER AMPLIFIERS, by Robert E. Sentz. Published by Holt, Rinehart and Winston Inc. U.S.A. Soft covers, 282 pages, 9in x 6in. Illustrated by numerous circuits and graphs. Price in Australia, $4.35.

The author of this book is also the co-author of another volume (Feedback Amplifiers and Oscillators) reviewed elsewhere in these notes and, in fact, the two books should be regarded as supplementary one to the other. All that was said of the first book, in regard to its level in technical literature, the type of reader to whom it is directed, and the educational level which he will need, applies equally to this book. In fact, the wording of the preface in this regard is almost identical in the two books.

The chapter titles are as follows: (1) Introduction. (2) Interstage Coupling Effects on Gain and Bandwidth. (3) The Input Impedance of an Amplifier. (4) Effect on Frequency Response of Incomplete By-passing of Emitter, Cathode, or Screen. (5) Gain-Bandwidth Product, Pulse Response of Wide Band Amplifiers. (6) Frequency Compensation Techniques. (7) Cathode and Emitter Followers. (8) Special Forms of Amplifiers. (9) Phase Inverters. (10) Direct Coupled Amplifiers. (11) Class A Single-Ended Power Amplifiers. (12) Push-Pull Power Amplifiers. (13) Class B and C Tuned Power Amplifiers.

At the end of the book there are answers to problems presented in the text and an appendix of transistor and valve parameters.

As before, we would emphasise that this book is intended for the engineer or advanced student who is mathematically equipped to digest it. While some portions of the text may be absorbed at a lower level, the approach is essentially mathematical and in some depth.

For those who have a need for such a book, either as an adjunct to a course of study, or as reference book at design level, this would appear to be a very good book and excellent value for the price.

Our copy from Holt, Rinehart and Winston (Aust.) Pty. Ltd., 79 Whiting Street, Artarmon, N.S.W. 2064. (P.G.W.)

Circuit treatment

ELECTRONIC CIRCUITS, by Samuel Seely, Ph.D. Published by Holt, Rinehart and Winston, Inc., New York, 1968. Hard covers, 6in x 9¼in, 752 pp., numerous circuits and diagrams. Price in Australia $14.65.

A modern electronics text for the engineer, engineering student and advanced technician. It assumes, in common with books of similar aim and stature, that the reader has a fairly solid background in modern circuit theory and mathematics. This granted, it offers a systematic and thorough introduction to the operation and analysis of modern electronic circuitry, with inevitable emphasis on semiconductors but dealing also with those aspects of thermionic valves and gas tubes which are still relevant.

In keeping with the modern outlook of

the book the author has achieved a high degree of integration of the "solid-state" and "tube" approaches to circuit design. At the same time circuits are differentiated into categories more logical, and of greater contemporary relevance to an understanding of basic operation and for the puprose of analysis. Thus considerable emphasis is placed upon "linear" vs. "switching" operation, both in connection with different circuits and in connection with the same circuit.

The circuits used for analysis and illustration are in many cases derived from modern literature and accordingly the book deals quite naturally, not only with valves and junction transistors, but also with FETs, tunnel diodes, unijunctions, avalanche diodes, integrated microcircuits and thyristors.

The chapter headings read as follows: 1—Characteristics of Electron Devices; 2—Active Network Theory; 3—Tubes and Transistors as Circuit Elements; 4—Small Signal Untuned Amplifiers; 5—Analog Computing Circuits; 6—Untuned Power Amplifiers; 7—Small-Signal Tuned Amplifiers; 8—Sinusoidal Oscillators; 9—Modulation and Demodulation; 10—Switching Mode Circuits; 11—Regenerative Switching Mode Circuits; 12—Sawtooth Generators; 13—Electronic Instruments; 14—Integrated Circuits; 15—Power Supplies.

Each chapter includes worked examples, and concludes with a set of tuitional problems. Throughout the text, many up-to-date topic references are given, while the book itself ends with two data appendices and a topic index.

In summary, a book which by virtue of both its form and content should be most valuable to the practicising engineer and to the undergraduate engineering student. It might well be worthy of consideration by university and college lecturers as a text for introductory and advanced electronics courses.

Our copy came from Holt, Rinehart and Winston (Aust.) Pty. Ltd., who advise that copies are in stock at all comprehensive and technical bookstores. (J.R.).

Transistor handbook

TRANSISTOR SUBSTITUTION HANDBOOK. Published by Foulsham-Sams, U.S.A. This edition printed in England by W. Foulsham and Co. Ltd., Slough, Bucks. Hard covers, 8¼ x 5¼in, 128 pages. Australian price $2.55.

Constructors wishing to build projects designed overseas may well find that transistors specified are not readily available here; again, people who have purchased imported equipment sometimes have trouble finding exact replacements for faulty transistors.

This book is intended to cater for those who want to find suggested substitutes quickly and easily and who are prepared to take the information given at face value, without going into such tedious matters as operating parameters! In other words, the alternatives are given, but no technical data. The only additional information listed comprises the manufacturers, an identification number referring to base diagrams, and an indication of polarity followed by "G" or "S" to indicate germanium or silicon.

The substitutes types have been selected by the ubiquitous computer. The introduction points out that the substitutes have been selected on the basis of performance and operating parameters, but that the suggested types do not necessarily have the same physical characteristics of the type to be replaced. However, in the case of power transistors, the computer was programmed to select substitutes having similar case styles and dimensions.

The technique of looking up substitutes without checking on parameters will undoubtedly work well enough in a majority of cases, but it should be borne in mind that in some instances "near enough" is not good enough. In some especially critical circuits, designers go to the trouble of making a note on the circuit "Do not substitute" where even slight changes in transistor characteristics can upset equipment performance. In such cases, recourse to technical data relating to the various substitutes proposed is essential. The publishers of this book point out that they have a companion work, "Transistor Specification Manual" where characteristics and parameters can be checked. This reviewer feels bound to point out that there are a number of substitution books available in which both sets of information are combined.

In addition to the main listing, the following additional sections are included:

Recommended Substitutes and Applications. This section lists all the general-purpose replacement types shown as substitutes in the main listing, with their general-purpose applications.

Alphabetical Listing of Applications. This has the same information as the above but arrange in different order — the applications are listed first in alphabetical order.

Terminal Guides. This section has diagrams of transistor bases to allow identification of emitter, base and collector. Each diagram is coded, and the codes relate to information contained in the main listing.

Key to Manufacturers. A key to abbreviations for manufacturers used in the book.

Because of distribution agreements, the edition sold in Australia is that prepared for the U.K. market, which has a foreword for the U.K. reader. However, the comments applicable to the U.K. do not seem to be at variance with Australian conditions.

Our review copy came from the U.K. publishers, but copies can be ordered in Australia either directly from the importers, Grenville Publishing Company, 401 Pitt Street, Sydney, N.S.W. 2000; or through technical book sellers. The Australian price is $2.55 (plus 20c postage if ordered by mail). (H.A.T.).

LITERATURE—in brief

ECONOMIC STUDIES AT THE NATIONAL LEVEL IN THE FIELD OF TELECOMMUNICATIONS (1964-1968) is a 152-page handbook bound in loose-leaf form published by the International Telecommunication Union (I.T.U.). The handbook is the result of studies carried out by the I.T.U.'s International Telegraph and Telephone Consultative Committee (C.C.I.T.T.) Special Autonomous Working Party No. 5 (GAS 5, from the French initials).

The handbook covers the following subjects: Factors affecting the supply and demand of telecommunication facilities; Analysis of demand for telephone stations; Economic factors which determine the development of telex and telegraph traffic; Investment required for telephone service; The part of the national economy devoted to telecommunications, method of financing. The handbook is available in English, French and Spanish, for 14 Swiss francs, from the Sales Section, International Telecommunication Union, Place des Nations, 1211 Geneve 20, Switzerland.

MARCONI INSTRUMENTATION, Vol. 11, No. 5(A), September, 1968. Published by Marconi Instruments Ltd., of U.K. Inquiries to Amalgamated Wireless (A'sia) Ltd., Mail Point 23, Box 96, North Ryde, N.S.W. 2113. Contents: Editorial—Standards; Waveguide Rotary Attentuators, Type 6052 Series; Marconi Instruments Calibration Service; AF Power Measurement; Oscilloscope for the Computer Age.

DELCO RADIO, Kokomo, Indiana, U.S.A., has published an eight-page booklet giving essential ratings of Delco power semiconductors, including silicon NPN transistors, germanium PNP transistors,

and silicon rectifiers. Copies of this booklet and a data sheet for germanium power transistors 2N441-3 are available on application under company letterhead from the Australian distributors, Industrial and Domestic Equipment Co., P.O. Box 163, Dandenong, Vic. 3175.

ECCOSHIELD MATERIALS FOLDER. Published by Emerson and Cuming, Inc., Massachusetts, U.S.A. Inquiries to Wm. J. McLelland and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W., 2208. Contents: descriptions with photographs of the variety of shielding approaches possible with Eccoshield RF shielding materials. Included are: Eccoshield PST pressure sensitive metallic tape with conductive adhesive; Eccoshield MNF conductive fabric; Eccoshield VX and VY conductive calks and sealer; Eccoshield ES conductive surface coating; Eccoshield SO and CO conductive greases. Shielding performance in terms of insertion loss possible with most of the approaches described is about 100dB.

MULLARD TECHNICAL COMMUNICATIONS, Vol. 10, No. 94, July, 1968, contains the following articles: Germanium microwave diodes for broadband mixer and low-level detector applications; Advanced techniques in radio frequency heating generator design; dielectric heater using half-wave line at 30MHz; A 400KHz induction heater of advanced design for powers up to 60KW; A 300KHz induction heater of advanced design for powers up to 120KW/240KW. Inquiries to Mullard-Australia Pty. Ltd., 25-43 Clarence Street, Sydney, N.S.W. 2000.

FAIRCHILD SHORT FORM CATALOGUE. Published by Fairchild Australia Pty. Ltd., 420 Mt. Dandenong Road, Croydon, Victoria, 3136 (P.O. Box 151, Croydon). Contents: A three way reference to preferred devices in the Fairchild range (1) Type No. to Applications. (2) Applications to Feature Parameters to Type No. (3) Type No. to Specification. Other sections—Special Features; Physical Dimensions; Integrated Circuits; Index to Application Notes; The Story of Fairchild Quality Control; Representatives and Distributors.

ECCOMOLD MOULDING POWDER CHART. Published by Emerson and Cuming Inc., of U.S.A. Inquiries to Wm. J. McLelland and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W. 2208. Contents: applications data including moulding temperatures and pressures, suggestions for mould designs, application selector table and processing note, for the Eccomold range of moulding powders.

M.I. CONTACT, issue 9 (E). Published by Marconi Instruments Ltd., U.K. Inquiries to Amalgamated Wireless (A'sia) Ltd., Mail Point 23, P.O. Box 96, North Ryde, N.S.W. 2113. Contents: MI-Sanders microwave products; Environmental testing; M.I. oscillators; Flexaguide flexible waveguides; TF 1099 20MHz sweep generator; A Question of Q?—the use of the Marconi Instruments TF 1245 circuit magnification meter; TF 2163/M2 programmable attentuator; For Immediate Delivery — instruments available from stock. Also company news.

SCIENTIFIC EQUIPMENT. Published by Watson Victor Ltd., 95-99 Epping Road North Ryde, N.S.W. 2113. New products magazine. Contents: API Contactless Meter-Relays; Goerz Electro Type RE 551 Servogor XY Potentiometric Co-ordinate Recorder and Minigor miniature recorder; Hygrodynamics Inc. Hygrometers; Nikon SMZ-2 Stereoscopic Zoom Microscope; Heidolph - Elektro Inset-Thermostat; Smiths Servoscribe Potentiometric Recorder (transistorised portable/desk type); Hilger and Watts Recording Infra-red Spectrophotometer (double beam); Nikon Measurescope Toolmakers Microscope; Sigrist Dust Measuring Apparatus; Multitone Pocket Paging System; Mufax Document Transmission System.

ATHOM NEWS. Published by Andrew Thom Ltd., 261 Broadway, Sydney, N.S.W. 2007. Products review. Contents: RLC component comparator; New electrophoresis apparatus; Colora Mini-cryostats; Specific ion measurement; Personal samplers of airborne contaminants; Middle-sized rotary vacuum evaporator; Mettler balances; Electronic measurement of mechanical events; Improved densitometer; Easy routine calorimetric titration; Modern system for precision calorimetry; Electronic analytical balance; Hycel reagents.

TECHNICALITIES, November, 1968. New products magazine published by Technico Electronics, P.O., Box 12, Marrickville, N.S.W. 2204. Contents: A range of new products including Radio Research Inc. AM/CW crystal controlled generator; Measurement Inc. FM signal generator; Rustrak Ltd. strain gauge recorders, DC and temperature recorders; Princeton Applied Research Corp. research instrument modules, boxcar integrator; Torr X-ray Corp. combination X-ray fluoroscope; Vitosonics Ltd. echograph ultrasonic flaw detection system, crack depth measurement; Pacific Measurement Inc. log/lin AC digital voltmeter; Torr Labs. Inc. miniature high voltage relays; F. W. Bell wattmeter transducers. Longer articles: Eddy Current Test Applications; The Characteristics of the Printed Motor.

B. and R. RELAYS POCKET GUIDE. Published by B. and R. Relays, Temple Files, Harlow, Essex, U.K. Contents; details of B. and R. most popular relays, contactors and reed switches, and similar equipment from Siemens and Halske, Adams and Westlake, Benedikt and Jager, Allied/Versa and Gordos. Format: fold-out sheet in slim plastic pocket book. ■

Notes and Errata

FIELD - EFFECT TRANSISTOR AVAILABILITY: Cannon Electric (Aust.) Pty. Ltd., Australian agents for Motorola Semiconductors, have advised that the MPF105 N-channel JFET used in our Guitar Preamp with Vibrato (November, 1968), Solid State Volt-Ohm Meter (December, 1968), and the Keyless Organ (January, 1969) has recently been superseded by the JEDEC type 2N5459. The latter is virtually identical with the MPF105 except for an uprated dissipation (310mW at 25 degrees C), and may therefore be used in all of the above projects without modification.

Cannon Electric also advises that in cases of temporary local unavailability of the 2N5459 it would be possible for constructors of the above projects to substitute the type MPF106, a high frequency device with tighter specifications and a slightly higher cost.

CAPACITOR TESTER, November, 1968. (Reader Built It.): The 6AM5 cathode follower in the circuit on page 99 is shown with the supressor grid connected to the plate via pin 6. In fact this grid is internally connected to the cathode in the 6AM5 and pin 6 has no internal connnection.

MODEL CONTROL TRANSMITTER, December, 1968. (Reader Built It): The type number of TR3 is incorrectly shown in the circuit diagram as a 2N3643. This should be an AC128. ■

AMATEUR BAND NEWS AND NOTES

Bushfires — WICEN provides a service

Members of the Wireless Institute of Australia WICEN organisation in New South Wales gave valuable assistance during the disastrous Blue Mountains bushfires.

By Pierce Healy, VK2APQ*

A very worthwhile adjunct to official communication channels was provided by members of the New South Wales Wireless Institute Civil Emergency Network when disastrous bushfires ravished the Blue Mountains district, west of Sydney, during the last week in November 1968. When the emergency first arose, K. Moore VK2AVN, established a base station at the emergency fire headquarters, Springwood, and quickly had a 146MHz mobile net in operation.

During the first few days of the emergency this net provided back-up communication outlets for the overloaded official channels and a large volume of traffic was handled. During the emergency a number of WICEN operators from Sydney travelled to the fire area to assist and relieve the local operators; also, the division's official station, VK2AWI, was manned at Wireless Institute Centre, Crows Nest, and handled traffic between the Blue Mountains and Sydney.

At the peak of the emergency, several special links were established at the request of the Civil Defence authorities, including one to handle traffic relating to residents being evacuated following the loss of their homes, who were being moved to the Penrith area.

During the operation three channels on the 146MHz band and two on the 53-MHz band were in use.

Those who assisted during the operation of the WICEN net were:

W. Moore	VK2HZ
W. Cromie	VK2MZ
B. Lear,	VK2ASZ
A. Outtrim	VK2EX
D. Boyd	VK2NR
R. Pinning	VK2CT
I. Bailue	VK2TN
F. Hill	VK2HQ
J. Greenhalgh	VK2ADF
T. Kinsella	VK2FK
D. Fullerton	VK2DU
H. Lapthorne	VK2HL
V. Cole	VK2VL
P. Campbell	VK2AXJ
D. Miller	VK2GN
K. Woodward	VK2BAU
G. Post	VK2BGP
R. Grevas	VK2AQX
P. Gibson	VK2LL
A. Smith	VK2ZFZ
M. Norman	VK2ZMN
D. Clift	VK2ZDE
A. Griffard	VK2ZMV
R. Walker	VK2ZLX
C. Jones	VK2ZDD
N. Dietch	VK2ZXC
G. Cruickshank	VKAZDR
J. Bennett	VK2ZGB
R. Ronai	VK2ZRZ
G. Clarke	VK2ZXD
I. MacKenzie	VK2ZIM
S. Little	VK2ZLS
D. Downie	VK2ZZD
I. Avery	VK2ZIA

Also shortwave listeners:

M. Sheppard
K. Rowe
J. Vale.

Many others offered their services but the situation eased and they were not called upon. A. Bles, VK2AVA, also assisted by making available equipment to the Civil Defence authority. It is also understood that a number of amateur operators manned the C.D.O. communication units.

Among those who were participating as members of the Civil Defence units were:

D. Wheaton	VK2AWW
N. Walker	VK2ZNS
R. Lopaz	VK2BRL
M. Pleffer	VK2MP
B. Neurath	VK2ZJN
A. Morgan	VK2AMY
G. Drew	— —
N. Bennett	— —

The Civil Defence net operated on 3732KHz.

RADIO STATION GB2SM

The story of this unique station came from Rex Black, VK2YA, following his visit overseas. Rex recommends all Australians who visit London should make a visit to the world-famous British Museum. He goes on: "Touring Australian amateurs will have a special interest in the excellent radio station, operated by the Museum staff, under the call sign GB2SM.

"Mr Voller and Mr Davidson are the two staff members qualified to operate the equipment, and each day, at 10.30 a.m. and 3 p.m., demonstrations of radio communication are made for the benefit of the people visiting the Museum. Most of these demonstrations are conducted on the amateur bands, but the conditions of licensing are quite unusual to Australians, as this station is classed as a "Government Radio Station" and, as such, it is in order for the operation to include contacts with non-amateur stations.

"In fact, regular schedules are maintained with the island of Tristan da Cunha in the Atlantic Ocean. The station is licensed by the Ministry for Science and Education, not by the G.P.O., although the call sign is allocated by the G.P.O.

"The equipment used and displayed in the station is, for the most part, on loan from the manufacturers. Some has been donated, and hardly any had been purchased from Museum funds.

"It is interesting to note that American Collins gear comprises the major part of the installation and this is because British manufacturers failed to see the advertising value in having their equipments on display while the Americans seized the opportunity to make equipment available as an advertisement for their products.

"The station comprises two main consoles, the first consisting of a Racal receiver, an Eddystone EA12 receiver and a Labgear LG300 transmitter. The transmitter is equipped with a VFO and has a single 813 in the final stage. It runs 150 watts on the amateur bands. On the Museum roof there is a Mosley (American) tower with Type TA36 multiband antenna. This was installed by the Ministry of Works.

"The second console is equipped with a Collins Type 75S-3B receiver, a Collins KWM2 transceiver, a Collins VFO Type 312B-5 and a Collins linear amplifier Type 30L-1, giving 400 watts PEP output. Other equipment on display included a Bendix frequency meter, a Ferrograph tape recorder, a modulation indicator, a reflectometer, selsyn indicator, R.F field indicator and an aerial tuning unit. In short, the whole set-up is calculated to generate a high-intensity envy in the minds of visitors, especially those who happen to be nomadic Australian radio amateur operators.

"One display case contained some 'home-brew' equipment, including a beginner's radio receiver made by Peter Smith, aged 15 years, which would compare with the best work of any Australian Youth Radio Scheme member.

"Although GB2SM is primarily a demonstration installation, it is easily seen that the Radio Society of Great Britain has had considerable interest in the project. Excellent displays of RSGB publications, maps, books, certificates and general amateur radio material serve to draw attention to the advantages and means of adopting amateur radio as a fascinating hobby. The fact that the Museum is invariably crowded with parties of school children ensures that GB2SM makes a serious impact on 'Young England.'

"During the demonstrations the spectator area is full of youngsters — and a sprinkling of adults — with ears strained to hear voices of amateurs from distant parts of the globe. During my visit contact was made with Steve K1ZVP/Mobile in Boston. Steve was operating a Ford station waggon with one hand at 75-mph and a Swan 350 with the other! Another QSO was with Bob W4CDC, who was putting out a 'five by eight' SSB signal from his 49ft tower.

"The radio section of the museum — apart from the GB2SM setup — is quite fascinating, with a display of ancient receivers and transmitting equipment going back to the days of coherers, loose couplers, spark transmitters and similar nostalgic impedimenta. Even without the radio attractions, the British Museum is a **must** for any tourist in London and it certainly cannot be 'taken in' at one visit only.

"It appears that the establishment of amateur radio stations in museums is not often done. The Franklin Institute in the United States of America operates an amateur station and one museum in Sweden is similarily equipped."

Rex concluded with an expression of thanks to Mr Davidson and Mr Voller for the friendly meeting with them. They are always very pleased to welcome itinerant amateur operators from the "colonies." He also expressed the hope that it might be possible for the Wireless Institute of Australia to arrange with local authorities to set up a similiar service to provide the public with an interesting demonstration of radio communication.

R.S.G.B.

The Radio Society of Great Britain has now moved to new premises and in future all correspondence should be addressed

*** News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W., 2200.**

to R.S.G.B. Headquarters, 35 Doughty Street, London, WC1. Telephone number is 01-837 8688.

I.T.U. NEWS

Among the decisions made by Study Groups of the International Radio Consultative Committee (C.C.I.R.) at a meeting in Geneva was: "The formation of an International Working Party to study the use of the geostationary orbit for communication satellites." It was decided that the Working Party should be under the chairmanship of the United Kingdom with the following administrations participating: Australia, Canada, Federal Republic of Germany, France, Japan, Poland, United Kingdom, United States of America, Union of Soviet Socialist Republics.

A draft study program was drawn up which included the study of:

1. Those technical characteristics of communication-satellite systems which affect the utilisation of the geostationary satellite orbit, and the inter-relationship between them.
2. The technical criteria that should be used to ensure an orderly development aiming at the most efficient and effective use of the geostationary satellite orbit.
3. The extent to which it may be feasible and desirable to adopt preferred technical characteristics for different geostationary communication-satellites and earth stations in order to improve the overall effectiveness of use of the orbit.

Some of the factors to be taken into account by the Working Party are:

The tolerable levels of interference noise in different satellite systems.

The apportionment of thermal, interference and intermodulation noise.

The radiation patterns of the earth station and satellite antennae.

Factors affecting the multiple use of the same frequencies within a single communication-satellite.

Errors in communication-satellite position and attitude.

Polarisation discrimination.

Also: "The adoption of a draft study program looking forward to the possible use of frequencies above 10GHz for satellite communication."

This study program will consider the possible use of such frequency bands to satisfy the requirements for wide frequency bands for communication-satellite systems. Since generally the available bandwidth of components is proportional to their operating frequency, the use of frequencies above 10GHz would facilitate the design of wide-band communication-satellite systems.

Despite the greater difficulties arising from increased atmospheric attenuation above 10GHz, the use of these higher frequencies could offer some technical advantages. These include greater facilities to provide multiple narrow-beam transmissions from a single satellite, and the ability to make use of more satellites occupying the same frequencies in a given arc of geostationary orbit than is possible in lower frequency bands.

Of the many reports presented at the meetings, one that should be of great interest to developing countries deals with the subject of methods of modulation in satellite communication systems and the multiple access problem, i.e. the use of a satellite by many earth stations. The use of new methods of modulation such as pulse code modulation (PCM) could possibly ease the problem of providing satellite communications for countries which have a relatively small amount of traffic.

The system of modulation used at present, wide-band frequency modulation, can provide only a limited number of channels within the bandwidth used. With PCM, a country could be assigned a "time slot" of just a few miscroseconds duration which is repeated say every thousanths of a second. Thus once every thousandth of a second a telephone conversation is sampled and encoded into a series of pulses. At the receiving end, the pulses are decoded and this series of small samples is sufficient to reconstruct the conversation. A large number of these time slots can be interleaved, each one providing a separate channel.

Another report dealt with the possible use of satellites for aeronautical and maritime communication. This work could lead to an improvement in communication with aircraft flying over sea or over areas where ground communication services are restricted.

A further report dealt with the use of satellites for the distribution of radio and television programs and also with the possibility of direct broadcasting from satellites.

Other subjects discussed included techniques to improve the quality in maritime radio communication services; characteristics of self-supporting antennae for use on ships; and the introduction of automatic direct printing telegraph equipment for ships.

Much of the work carried out is in preparation for the next World Administrative Space Conference which the I.T.U. plans to hold at the end of 1970 or early in 1971.

This information is included in these notes to enable thinking amateurs to consider some of the possible avenues for experimentation in the VHF/UHF field and as an insight into things to come on the international scene.

The 1970-1971 I.T.U. conference could affect the higher amateur frequency allocations and this should be an incentive to amateurs to subscribe to the W.I.A. I.T.U. fund and support the aims of the International Amateur Radio Union Region III organisation.

W.I.A. ACTIVITIES

Attention is drawn to the change in the rules of the John Moyle Memorial National Field Contest appearing in these notes. The amendment has been made in accordance with the decision of Federal Council at the 1968 Federal Convention held in Sydney.

The period of the contest has been extended to a continuous period of 26 hours. Stations may operate during any consecutive 24-hour period within the 26 hours.

It had been the expressed view of many contestants that the finishing time of 6 p.m. (0800 GMT) was too late in the eastern states. This change will allow contestants in the eastern states to finish at 4 p.m. (0600 GMT) should they so desire but will not interfere with contestants in the western states should they wish to continue until 0800 GMT (4 p.m. WST).

NEW SOUTH WALES

Last month's notes had the news of Don Miller's election as president of the New South Wales Division, following the resignation of Keith Finney. A typographical error was made in Don's call sign which should have read VK2GN.

The VHF and HF antenna system has been completed for the communication centre at Wireless Institute Centre, 14 Atchison Street, Crows Nest. Provision has been made for the 52MHz and 146MHz bands, as well as a trap vertical for the 3.5MHz and 7.0MHz bands.

The centre was used to handle emergency traffic for the first time during the disastrous bush fires in the Blue Mountains on Thursday, November 28, 1968. The antenna systems had only been completed the previous weekend.

On Sunday, December 1, 1968, the first long distance multi-repeater test was successfully carried out by members of the New South Wales VHF group. During the Sunday morning news broadcast from VK2WI at Dural, a link was established through to Canberra.

All told, three repeaters were used in the test. The first link was from Dural to Mount Bold, near Newnes Junction,

VALE

It is with deep regret that the death is recorded of Phil Renshaw, a Life Member of the New South Wales Division of the Wireless Institute of Australia. Phil was a signatory to the Memorandum and Articles of Association of the N.S.W. Division when it was incorporated in 1922.

Also

Bob Pinning, VK2CT, a member of the Blue Mountains Branch, who collapsed and died on returning home after assisting in fighting the bush fires in the Blue Mountains during the emergency reported in these notes.

To the families of both these members, deepest sympathy is extended from their many friends.

where a repeater was manned by Ross Mudie, VK2ZRQ, and powered from 12-volt batteries. From there, the relay was through the Orange Radio Club Repeater at Mount Canobolas, near Orange; then to Mount Ginini south-west of Canberra, where a battery-powered repeater was manned by Chris Jones, VK2ZDD. The final stage was to Reg Miles, VK1ZMR, in Canberra, who gave a short resume of news on behalf of the Canberra Radio Society.

Reports on the test by members throughout the State indicated that reception of the Canberra signals, relayed through VK2WI on 7.146KHz, was very satisfactory.

The purpose of the test was to check the feasibility of using links to relay news of interest during divisional broadcasts and later as a system whereby VHF communication could be made with various areas of the state.

Central Coast Branch

A vote taken at the November meeting of the Central Coast Branch was unanimously in favour of continuing the club meetings at Kariong Hall. The meeting was treated to an excellent lecture on the use of integrated circuits in receiver construction, by Ian Fyfe, VK2ZIF.

The final date for the annual field day of the branch had not been decided at the time these notes were being prepared.

Blue Mountains Branch

A successful field day organised by members of the Blue Mountains Branch was held at Lawson on Sunday, November 17, 1968. There were 43 registrations with visitors from Forbes, Bathurst, Gosford and Sydney. Field events, all held on the 144MHz band, were keenly contested. A novelty 146MHz "Talk-in" event, where contestants lost points for each question asked, reduced transmitting activity to a minimum and was a test of patience on the part of the operators.

QUEENSLAND

Members of the Queensland Division W.I.A. have been asked by the Divisional Council to give serious thought to nominating for the 1969 election to Council.

Bribie Island has been selected as the venue for the 1969 State convention and arrangements are in the hands of Ross Cuttle, VK4ZAT.

A Famfest

The unique "Famfest" gathering was held at Currumbin on the south coast of Queensland on Sunday, November 17, 1968. It is the only gathering in Australia where W.I.A. members and their families from two states hold a combined family picnic. There were no organised events. The weather was perfect, eyeball QSOs being the order of the day, both for the OMs and XYLs while the children made use of the nearby beach.

The total attendance was 124, which included 13 New South Wales and 26 Queensland licensed amateur operators. Wives and young ladies totalled 28; children 39; visitors 15. Other amateurs present were Ian VK3MO, Pat ZL1AXB and Bill VK9WD.

The callsigns of those present were:

VK2s:

BTK John, ... from Ballina;
BB Eddie, ... from Murwillumbah;
AIM Ivan, ... from Sydney;
AQR Bob, ... from Avoca
GI Keith, ... from Maclean;
BGF Geoff, ... from Taree;
ZLQ Laurie, ... from Murwillumbah;
AVS Ivan, ... from Murwillumbah;
BGG Jack, ... from Lismore;
ZFS Ted, ... from Lismore;
ZES Horrie, ... from Nimbin;
BEJ Ewart, ... from Murwillumbah;
KA John, ... from Lsimore.

VK4s:

LW Graham, ... from Brisbane;
ES Herb, ... from Brisbane;
FA Don, ... from Brisbane;
XY George, ... from Brisbane;
RE Ron, ... from Brisbane;
XP Geoff, ... from Brisbane;
SA Stan, ... from Brisbane;
ZDC Doug, ... from Brisbane;
ZFD Ross, ... from Brisbane;
ZRM Roy, ... from Brisbane;
PJ Peter, ... from Brisbane;
ZC Dave, ... from Brisbane;
TF Rod, ... from Ipswich;
HW Dave, ... from Ipswich;
ZN Wayne, ... from Ipswich;
ZLG George, ... from Ipswich;
RG Ron, ... from Ipswich;
GT Warren, ... from Ipswich;
CR Cyril, ... from Ipswich;
LX/M Merv, ... from Ipswich;
ZAT Ross, ... from Bribie Island;
FK Geoff, ... from Rockhampton;
KH Keith, ... from Toowoomba;
HZ Jim, ... from Gympie;
ZDA Mike, ... from Broadbeach;
MY Doug, ... from Gold Coast.

After lunch, at a short meeting chaired by Eddie VK2BB, it was decided that the next "Famfest" would be held at Kingscliff, on the New South Wales side of the border, on the Sunday of the Six-Hour Day holiday weekend. It was thought that the holiday weekend could result in an increased attendance from New South Wales members.

A period of silence was observed in memory of the late Bill Selby, VK4WS, who had been a staunch supporter of these family gatherings. At the invitation of the chairman, Ivan Agar, VK2AIM (past president of the N.S.W. Division W.I.A. and representing the Divisional Council) spoke briefly and said that the main purpose of his attendance was to express his appreciation to the nothern members for the way they had taken up this idea of family get-togethers so enthusiastically and made a success of them. He urged that all concerned never let these "Famfests" die out.

SOUTH AUSTRALIA

For the past eight years the journal of the South Australian Division has been edited by Brian Austin, VK5CA. Due to a bout of ill health Brian has been forced to relinquish the position. The appreciation of the council and members of the division for the service he has given to the W.I.A. has been expressed by bestowing honorary life membership of the division.

As from the December issue, the journal will be edited by Alan Isaachsen, VK5ZEI. Alan's address is 24 Seafield Avenue, Kingswood, South Australia 5062.

The results of the intrastate contest were:

Metropolitan Section—Full Licensees:
A. C. Rechner, VK5EK .. 14280 points
Country Section—Full Licensees:
J. S. Burns, VK5UJ .... 1060 points
Metropolitan Section—Limited Licensees:
A. W. Attema, VK5ZAR .. 13984 points
Country Section—Limited Licensees:
V. L. Schwinger, VK5ZSV . 60 points
C.W. Section:
A. J. Hewitt, VK5XK .. .. 561 points

W.I.A. YOUTH RADIO SCHEME

During 1968 the Wireless Institute of Australia Youth Radio Club Scheme continued to provide a source of instruction and education for school students and young people wishing to increase their knowledge of radio and electronics. With the commencement of the school year in 1969 it is anticipated that several new clubs will be formed. To obtain the maximum benefit and assistance, club leaders are urged to register with their state supervisors as early as possible.

Details of the Youth Radio Club Scheme can be obtained from:

Federal Co-ordinator: J. Webster, 25 Bayview Avenue, Earlwood, N.S.W. 2206.

N.S.W. Supervisor: D. Jeanes, Villa Maria, Ayr Street Rockdale, N.S.W. 2216.

Victorian Supervisor: M. Plummer, 71 Keran Street, Strathmore, Victoria 3041.

South Aust. Supervisor: Rev R. Cuthbertlet, 2 Claring Bould Road, Christies Beach, South Australia 5165.

Queensland Supervisor: D. Dwyer, W.I.A. Box 638 G.P.O. Brisbane, Queensland 4001.

Western Australia Supervisor: Rev. Bro. J. Morgan, Christian Brothers College, Franklin Street, Leaderville, W.A. 6007.

Tasmanian Supervisor: R. Emmett, 6 Haig Street, Lenah Valley, Tasmania 7008.

The interest, enthusiasm and work being done in promoting Youth Radio Club Scheme activities, and the opportunities to learn more about radio communication and electronics made available through the scheme to young people, are illustrated by an interview recently recorded by Harry Roberts, VK5MY, with John Allan, VK5UL, for a W.I.A. broadcast from VK5WI. John is a councillor of the South Australian Division of the W.I.A. and is Y.R.C.S. liaison officer.

"My business activities make it necessary for me to visit country areas at odd times through the year and I take advantage of these trips to establish personal contact with as many of the country clubs as I can, when I am in their respective areas. So far I have visited the following clubs — Gladstone, Waikerie Port Pirie, Port Augusta, Elizabeth, Peterborough, Kadina, and Gawler.

"I find that these people are very pleased to know that somebody in Adelade is taking an interest in their activities and that they are not entirely forgotten as far as their club activities are concerned.

"The majority of clubs is affiliated with the Wireless Institute of Australia and they like to know that someone is taking a personal interest in their activities.

"Most of the large clubs are being managed by licensed amateurs. Quite a number of high school clubs are administered by the school science master. This is a good thing in some respects, but it also has its disadvantages in that quite often the master concerned is moved on to other schools and the club fails for the want of proper supervision. This is not always the case — some of them manage to keep going without the supervision of a master where one of the members is sufficiently enthusiastic and qualified to keep the club going.

In giving an outline of a typical visit to a club, John said:

"Probably the most successful club that I have visited is the Port Pirie club, under the supervision of Bert Hollebon. I deliberately stayed overnight in Port Pirie when I was in that area and spent the evening with Bert and his band of enthusiasts, just to see how this club is organised and how they work.

"It was quite an eyeopener to me to see this club in action. First of all, Bert meets up with his three other helpers, Jim McDonald, Harry Johnston and Harry's youngest son (who incidentally, has a limited amateur operator's licence). They have a rendezvous and they arrange to pick up the boys in their own vehicles at a certain spot and then convey them six or seven miles out to the old R.A.A.F. radio room at the aerodrome which has been made available to the boys by the Port Pirie council.

"On arrival they are divided up into their various groups and gradings. Some are busy building equipment, some are doing Morse code practice, others are doing theory under the guidance of the four instructors. This continues until about 9.30 p.m. when it is time to close down and return to Port Pirie.

"I might add, it is quite a noisy session and the boys seem not only to be interested in their radio activities, they appear also to be enjoying themselves at the same time. I was impressed with Bert's manner of handling this session, allowing a certain amount of licence and a certain amount of amusement among the boys to maintain their interest.

"After the club activities had finished, they were all loaded back into the vehicles and dropped off at their respective homes. I was very impressed with the amount of time and effort being expended by the four enthusiastic instructors and administrators in keeping these boys occupied for two or three hours of an evening, getting them out to the club room and getting them safely home again. I feel that this is one Youth Radio Club that is serving a very useful purpose in the local community.

"The general pattern is followed fairly closely by other clubs — Port Pirie is, of course, one of the larger clubs. This would apply to Elizabeth, who, with their larger numbers, are able to keep more organised and possibly run more smoothly. Some of the other clubs lacking in numbers and not always with proper supervision possibly do not function as effectively or efficiently but they are achieving something — and this I think is important.

"As yet I have not visited all the country clubs. It has not been convenient to do so, but I hope within the next 12 months to have called on all our affiliated clubs in the country and made their acquaintance and do whatever is possible to help them."

John's reply to a question regarding an appeal made for assistance in forming and running a Youth Radio Club in Adelaide, was:

"There has been no one come forward so far. This is a great pity, because there is an urgent need now for a club in Adelaide. There are so many boys who have left school and of course cannot be associated with any high school activity. Some may have left school and be looking for somewhere they can apply themselves to this study and this hobby. The only hold-up is the lack of volunteers to supervise and guide these boys and until such time as somebody does come forward we cannot get a club under way.

"There is an urgent need now. I get quite a lot of inquiries from young chaps out of high school, just starting work and anxious to continue their interest in electronics either as a hobby or possibly with some professional future."

Full details of the W.I.A. Youth Radio Club Scheme in South Australia, can be obtained from:

State Cordinator, Rev. Bob Guthberlet, VK5OD, 2 Claring Bould Road, Christies Beach, 5165,

or

Secretary, Allan Dunn, 18 McKinlay St, Elizabeth Downs, 5113.

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659 B

Elizabeth Amateur Radio Club

The Elizabeth Amateur Radio Club held a very successful "end of the year" night for the Youth Radio Group with over 70 persons in attendance. Mr J. Ladbrook of the Department of Civil Aviation was the guest speaker. Tom Laidler, VK5TL, Divisional President and Geoff Taylor, VK5-TY, Federal Councillor represented the Wireless Institute of Australia.

Certificates were presented to successful candidates for the Junior Certificate. The results were:

Credit: Paul Clemence.

Pass: Michael Bloodworth, John Ellershaw, Jeffry Loveday, Robert Worthington.

Port Augusta Youth Radio Club

An Elementary Examination was conducted at the Port Augusta Youth Radio Club on October 26, 1968, at which the following candidates were successful:

Credit Pass: Paul Daniels, John Veljkovic, Henry Zacher.

Pass: Dietmar Lindner, David Osborne.

Prince Alfred College Y.R.C.

The first Elementary Certificate examination to be held at the Prince Alfred College Youth Radio Club was conducted on October 30, 1968. The results were as follows:

Honours: John Gilbert, Thomas Jones.

Credit: Mark Denton Michael James, David Morrow, Derek South.

Pass: Peter Daenke, Jonathon Horner, Christopher Kneebone.

Port Pirie Youth Radio Club

Successful students of the Port Pirie Youth Radio Club at the Elementary Certificate examination were:

Honours: Gregory Mackrill.

Credit: Michael Meaney, Michael Vawser.

Pass: John Caldecott, Stephan Eberhard, David Green, Emanuel Kouimtzis.

NEW SOUTH WALES

For the two months prior to November last, 43 Elementary and five Junior certificates were awarded to successful club members in New South Wales. Among these were:

Lismore Police Boys' Radio Club

Bruce Sunderland,	Credit Pass.
Kim Stevens,	Pass.

St. Michael's High School Radio Club, Wagga Wagga.

James O'Brien,	Credit.
Alan Lonsdale,	Credit.
Andrew McClure,	Credit.
Paul Salter,	Pass.
Chris Thorne,	Pass.
Stephan Cox,	Pass.
Michael Hodgson,	Pass.

Parramatta Marist Brothers' High School Radio Club

Peter Callaghan,	Honours.
James Kennedy,	Honours.
Philip Murphy,	Credit.
Daniel Casey,	Pass.
Gerald Cash,	Pass.
Guy Campbell,	Pass.
Grahame Kelly,	Credit.

Maitland Radio Club

One of the members who has recently joined the Maitland Amateur Radio Club is Linda Tinson, a 3rd Form Student at the Maitland Girls High School. Linda is studying for the Y.R.C.S. Elementary Radio Certificate as well as attending the telegraphy class on Tuesday evenings. Progress reports of the classes show that she has no trouble in keeping up with the average student.

Linda's interest in radio was fostered by her active participation in the maintenance of an electric guitar played by her brother. The club committee is impressed with her present progress and hopes to contact other girls who have an interest in radio and electronics.

Late in November, the club conducted further examinations for the Y.R.C.S. Elementary and Junior Grade certificates.

JOHN MOYLE MEMORIAL FIELD DAY

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian Amateur and Short Wave Listeners to participate in this Annual Contest, which is held to perpetuate the memory of John Moyle, whose efforts advanced the Amateur Radio Service.

There are two divisions of this Contest ,one of 24 hours' continuous duration, and one of 6 hours' continuous duration. The six-hour period has been included to encourage the operator who is unable to participate for the full 24-hour period.

Operators using 25 watts or less input to the final stage will be considered for a certificate where their activities warrants its issue.

DATE:—

From 0600GMT, 1st February, 1969, to 0800GMT, 2nd February, 1969.

OBJECTS:—

The operators of Portable and Mobile Stations within all VK Call Areas will endeavour to contact other Portable/Mobile and Fixed Stations in Australia and Overseas Call Areas.

RULES

1. There are two divisions, one of six (6) hours, and one of twenty-four (24) hours' duration. The six-hour period for operating may be chosen from any time during the Contest, but the six-hour period so chosen must be continuous. In each division, there are six sections:—
   (a) Portable/Mobile Transmitting, phone.
   (b) Portable/Mobile Transmitting, C.W.
   (c) Portable/Mobile Transmitting, open.
   (d) Portable/Mobile Transmitting, Multiple Operation, open only.
   (e) Fixed Transmitting Stations working Portable/Mobile Stations, open only.
   (f) Reception of Portable/Mobile Stations.

2. All Australian Amateurs are encouraged to take part. Operators will be limited to their licensed power. This power shall be derived from a self-contained and fully portable source.
   (a) Portable—Mobile Stations shall not be situated in any occupied dwelling or building. Portable/Mobile Stations may be moved from place to place during the Contest.
   No apparatus shall be set up on the site earlier than 24 hours prior to the Contest.
   All Amateur bands may be used, but no cross band operation is permitted. Cross mode operation is permitted.
   Entrants in Section (d) for Multiple Operator Stations can set up separate transmitters to work on different bands at the same time. All such units of a Multiple Operator Station must be located within an area that can be encompassed by a circle not greater than half a mile diameter.
   For each transmitter of a Multiple Operator Station a separate log shall be kept with serial numbers starting from 001, and increasing by one for each successive contact. All logs of a Multiple Operator Station shall be submitted by the operator under whose Call Sign the transmitters are working. No two transmitters of a Multiple Operator Station are permitted to operate on the same band at any time.

3. Amateurs may enter for any section.

4. One contact per station for phone to phone, also one for C.W. to C.W. per band is permitted. Cross mode operation will be accepted for scoring.

5. Entrants must operate within the terms of their licences and in particular observe the regulations with regard to portable operation.

6. Serial numbers consisting of RS or RST report plus three figures commencing with 001 and increasing by one for each successive contact shall be exchanged.

7. **SCORING:—**
   (a) **Portable/Mobile Stations:**
   For contacts with Portable/Mobile Stations outside entrant's Call Area. 15 points.
   For contacts with Portable/Mobile Stations within entrant's Call Area. 10 points.
   For contacts with Fixed Stations outside the entrant's Call Area. 5 points.
   For contacts with Fixed Stations within the entrant's Call Area. 2 points.
   (b) **Fixed Stations:**
   For contacts with Portable/Mobile Stations outside entrant's Call Area. 15 points.
   For contacts with Portable/Mobile Stations within entrant's Call Area. 10 points.

8. The following shall constitute Call Areas: VK1, VK2, VK3, VK4, VK5, VK6, VK7, VK8, VK9 and VK10.

9. All logs shall be set out under the following headings: Date/Time (GMT), Band, Emission, Call Sign, RST/No. Sent, RST/No. Received, Points Claimed. Contacts must be listed in numerical order.
   In addition, there shall be a front sheet showing the following information:—
   Name .....
   Address .....
   Call Sign ..... Section .....
   Division ..... (6-hour or 24-hour)
   Points Claimed .....
   Call Sign on other operator(s) (if any) ....
   Location of Portable/Mobile Station .....
   From ..... hours to ..... hours
   A brief description of equipment used, and points claimed, followed by the declaration:—
   "I hereby certify that I have operated in accordance with the rules and spirit of the Contest."
   Signed .....
   Date .....

10. The right is reserved to disqualify any entrant who, during the Contest, has not observed the Regulations and the Rules of this Contest, or who has consistently departed from the accepted code of operating ethics.

11. The decision of the Federal Contest Manager of the Wireless Institute of Australia is final and no disputes will be entered into.

12. Certificates will be awarded to the highest scorer of each section of each division. Additional certificates may be issued at the discretion of the F.C.C. The six-hour certificates cannot by won by a 24-hour entrant.

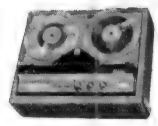
13. **RETURN OF LOGS:**
   All entries must be postmarked not later than February 28, 1969, and be clearly marked "John Moyle Memorial National Field Day Contest, 1969," and addressed to:
   Federal Contest Manager, W.I.A.,
   Box N1002, G.P.O., Perth, 6001,
   Western Australia.

RECEIVING SECTION

14. This section is open to all Short Wave Listeners in VK Call Areas. The rules shall be the same as for the Transmitting Stations, but may omit the serial numbers received.
   Logs must show the Call Sign of the station heard, the serial number sent by it, and the Call Sign of the station being worked.
   Scoring will be on the same basis as for transmitting stations. It will not be sufficient to log a station calling CQ. A station may be logged once only for phone and once for C.W. in each band.
   Awards:—Certificates will be awarded for the highest scorer in each Call Area.

SCHAUB-LORENZ SL200 TAPE RECORDER

All-transistor stereo tape recorder (four-track model) for stereophonic recording and playback. Adjustable to two tape speeds: frequency response from 60-12,500 c/s (at 3¾ ips), 40-16,000 c/s at 7½ ips). High output power and remarkably pure tone delivered by two transformerless push-pull output stages with the exceptionally high overall gain of an approx. 12-watt power (music).



UNIT 1: Schaub-Lorenz Model 200 stereo tape recorder illustrated above complete with Dual 1010F turntable and 2 Heco Twin speaker systems complete in fully imported cabinets from Germany. **TOTAL PRICE $400**

UNIT 2: Armstrong Model 127 tuner/amplifier frequency response from 40-20,000 cycles, made in England, 2 Wharfedale 8" RSDD loudspeakers, Dual 1010F turntable. **TOTAL PRICE $250**

UNIT 3: Sansui AU-222 magnetic input stereo amplifier, P.E. 34 HI-FI belt-driven turntable (our cost for the turntable is $64.00), 2 Goodmans 10" Twinaxiette loudspeakers, Empire 808 cartridge frequency response from 10-20,000 cycles. **TOTAL PRICE $268**

UNIT 4: 2 Leak Sandwich loudspeakers, Armstrong 226 tuner/amplifier, magnetic input 10-watt RMS per channel frequency response from 30-20,000 cycles plus or minus 1 dB less ½% distortion measured at 8-watts RMS per channel, ERA Mk. 3 turntable, Empire 888E cartridge frequency response from 10-30,000 cycles. **TOTAL PRICE $640**

UNIT 5: Ampex Model 2163 tape recorder, Dual 1019 turntable, 2 Leak Mini Sandwich loudspeakers. **OUR PRICE $840**
TOTAL RETAIL PRICE $1018.00

UNIT 6: 2 Empire Model 2000 world's finest loudspeakers, frequency response from 30-18,000 Hz, components: 10-inch high-compliance woofer with 2" voice coil. Mid-range/tweeter, direct radiator, less than one foot square and 16½ inches high. Power handling capacity: 60 watts, undistorted Armstrong Model 421 fully transistorised stereo amplifier, 15-watt RMS per channel frequency response from 20-20,000 cycles plus or minus 1dB less than ½% distortion on the full 15-watt RMS, ERA Mk. 4 turntable, with Empire 888VE cartridge. **TOTAL PRICE $795**

UNIT 7: 2 Tannoy 12" Dual Concentric loudspeakers, Armstrong 426 fully transistorised tuner/amplifier, made in England, 15-watt RMS per channel frequency response from 20-20,000 cycles plus or minus 1dB less than ½% distortion on the full 15-watt RMS. Dual 1015 turntable, Empire 888 cartridge, frequency response from 10-24,000 cycles. **TOTAL PRICE $645**

UNIT 8: Harman Kardon Model 210, 50-watt output, most advanced integrated stereo tuner/amplifier from the U.S.A., frequency response plus or minus 1dB: 8 to 25,000 Hz at 1 watt (normal listening level); 10 to 23,000 Hz at full rated power, 2 Empire 2000 loudspeakers frequency response from 30 to 18,000 Hz, ERA Mk. 3 turntable, Empire 888VE cartridge, frequency response from 6 to 32,000 cycles. **TOTAL PRICE $1,375**

UNIT 9: Empire 8200 Imperial Grenadier loudspeakers, frequency response from 30-20,000 cycles, nominal impedance: 8 ohms, power handling capacity, music power maximum undistorted 100 watts, Armstrong 226 tuner/amplifier 10-watt RMS per channel, frequency response from 20-20,000 cycles plus or minus 1dB less than ½% distortion measured at 8-watts RMS per channel, Dual 1019 turntable, Empire 888TE cartridge frequency response from 6 to 32,000 cycles. **TOTAL PRICE $1,200**

UNIT 10: Jordan Watts loudspeakers (2) frequency response from 25-20,000 cycles, 12-watt RMS, Schaub-Lorenz Model 4000 tuner/amplifier 24-watts per channel AM/FM shortwave longwave, ERA Mk. 3 turntable, Empire 88TE cartridge frequency response from 6 to 32,000 cycles. **TOTAL PRICE $540**

UNIT 11: Schaub-Lorenz Stereo dirigent stereo amplifier, high output power of the two push-pull output stages each delivers 8-watts, FM stereo decoder with automatic switching, Schaub-Lorenz STL201 loudspeakers, 2 Twin speaker systems fully imported from Germany complete in cabinets, Dual 1015 turntable complete with cartridge. **TOTAL PRICE $445**

UNIT 12: Armstrong Model 227 stereo tuner/amplifier, 10-watt RMS per channel, frequency response from 30-20,000 cycles plus or minus 1Db less ½% distortion measured at 8-watts RMS per channel, Garrard SP25, Decca Deram cartridge, 2 Goodmans Twinaxiom loudspeakers. **TOTAL PRICE $299**

RECORDED MUSIC SALON

C. PINCZEWSKI

TRUE FIDELITY

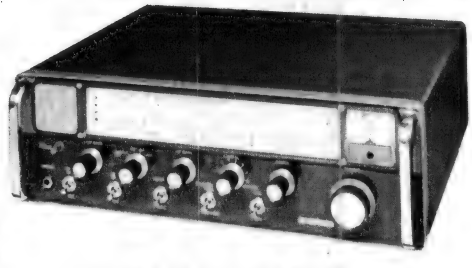
WHOLESALE AND TRADE ENQUIRIES WELCOME

23 COLLINS STREET, MELBOURNE 3000
Telephone 63-6257

Eddystone

990 R

VHF COMMUNICATIONS RECEIVER



Intermediate Frequency
10.7 MHz. Output of up to 50 millivolts is available at low impedance from B.N.C. co-axial socket.

IF Bandwidth
30 kHz and 200 kHz.

Range 1 . . .	127—240 MHz.
Range 2 . . .	75—127 MHz.
Range 3 . . .	46— 75 MHz.
Range 4 . . .	27— 46 MHz.

AVAILABLE NOW EX-STOCK OR BOND STORE.

The Eddystone model "990R" is a fully transistorised single conversion receiver for reception of CW, AM and FM signals in the range of 27-240. The full tuning range is covered in four switched bands, with the R.F. unit having three gang-tuned signal circuits prior to the mixer. Local oscillator arrangements permit operation with crystal control from any one of eight switched frequencies in addition to manual tuning.

An intermediate frequency of 10.7 M/Hz is used and bandwidths of 30 kHz and 200 kHz are provided as standard, the former employing a crystal filter, alternative filters being available to order.

Separate wide and narrow bandwidth outputs are available at the intermediate frequency. The former is a low level output intended for driving the companion Panoramic Display Unit (Model ER17R) via an external converter, bandwidth being of the order of 1 MHz at the higher frequencess. Video output is available on both AM and FM.

AUSTRALIAN AGENTS
R.H. Cunningham PTY. LTD.

608 COLLINS ST., MELBOURNE, VIC., 3000. 61-2464.
64 ALFRED ST., MILSON'S PT., N.S.W., 2061. 929-8066.
L. E. BOUGHEN & CO., 95 CENTRAL AVE., SHERWOOD, QLD., 4075. 79-2207.

The results for the Elementary certificate were:

B. McNally, F. Jarvis and S. Wallace gained Honours.

P. Thompson gained a Credit Pass.

N. Ryan and S. Fairlamb gained Pass marks.

The Junior Certificate results were:

K. James and T. May, Credit pass.

R. Sams, Pass.

The certificates were presented to the successful members by the Club Patron, Dr R. H. K. McKerihan, at the Club's Christmas meeting in the C.W.A. Hall, East Maitland.

The club's building program has been considerably advanced by the donation of material by Mr C. G. Cooke, for the erection of a 45ft tower. The donation was made in appreciation of the work done by the club in the Maitland district.

Work is progressing on the completion of the lecture room at the club's premises. Desks to seat 12 students have been installed, fitted with morse keys, headphone jacks and key switches. The room can now be used for telegraphy practice as well as theory lectures. Electronic equipment for the project as well as the equipment for the communications centre is being completed as part of the workshop program.

At a recent meeting of the Maitland Radio Club News publication committee, it was suggested that the committee approach Mac O'Brian, VK2ZMO, of Raymond Terrace, to cover activities on the VHF bands in the Hunter Valley. Subsequently the invitation was accepted and readers of the M.R.C. News will now receive up-to-the minute reports on VHF activity in the Hunter Valley.

All inquiries regarding the club's activities should be made to the Secretary, Maitland Radio Club, Box 54 P.O. East Maitland. 2323, or by phoning Maitland 33-7286. Items of news and information regarding the club magazine should be addressed to the Editor, M.R.C. News at the above address.

Westlakes Radio Club

An imposing record, and one which any club would be proud of, is that of the Westlakes Radio Club. A total of 20 have gained their A.O.C.P. or A.O.L.C.P. while studying as members of the Club and are now active amateur radio operators. An equally outstanding number of Y.R.S. certificates in all grades have also been won by members.

Among those who gained their amateur licence were Ian Forrest, VK2AJF, the first schoolboy to be licensed in Australia and Susan Brown, VK2BSB, the first schoolgirl to receive an amateur licence in Australia. Colin Christiansen, VK2BCC, who subsequently gained a 1st Class Commercial licence, is now a Radio Inspector in the P.M.G. Radio Branch.

VICTORIA

The number of certificates issued each year to successful students in Victoria continues to increase. Among the results that have come to hand were:

Wodonga Technical School Radio Club: Elementary Certificates awarded to:

David Caddy,	Honours Pass.
Ronald Bertrand	Credit Pass
Edward Lawrence	Credit Pass.
Terry Riley,	Pass.
Linton Schier,	Pass.
Kent Taylor,	Pass.

St. John's College Radio Club: Elementary Certificate awarded to

Ian Malloy, Credit Pass.

In the examinations associated with the Correspondence Section, 14 Elementary and nine Junior certificates were awarded. The correspondence section caters for those who are unable to join a school club and wish to increase their knowledge of radio and electronics.

Applications for membership and other details can be obtained by writing to the Correspondence Section, Supervisor, W. Tremewen, 34 Flower Street, Ferntree Gully, Victoria. 3156. ■

Documentary Records . . . from page 79

Western philosophy. Swearing, happiness and punning are some of the other subjects given the eloquent attention of the panel members.

The expert editing ensures a smooth presentation from start to finish. An album to share with friends who enjoy the stimulus of good company and conversation.

★ ★ ★

RICH LITTLE'S BROADWAY. Impressions of 32 well-known stars as they might appear on Broadway. Rich Little with the CBC Network Orchestra. Parlophone Stereo, SPMEO 9453.

Rich Little—one is tempted to call him Little Richard—did a club season in Sydney about the middle of last year and I'm told that his act was first-class entertainment. This is perhaps the secret of impersonations; they make a far greater impact when there is a natural empathy between the entertainer and his audience.

It could be that too many entertainers are doing impressions these days. In fact I can think of a whole string of American visitors who have included a bagfull in their act. The choice is inevitable; Edward G. Robinson, James Cagney, Peter Lorre, Boris Karloff, James Stewart, John Wayne . . . if it were not for the screening of ancient movies on TV, some of the voices and names would be quite inexplicable to younger people in the audience. That so many have done impressions of them for so long is perhaps a rather special kind of tribute to the durable qualities of many of America's show business personalities.

On this album Mr Little has added a new dimension, as it were, in what the cover note describes as "The ridiculous sounds of top Broadway tunes sung in the impersonated voices of great non-singing personalities." On the surface a clever idea, but not when spread out over two sides of an LP. And these are only 32 of the 143 voices in the repertoire of Rich Little. Where time often flies in a live performance, it drags here as one gravelly out-of-tune voice follows another. Listening fatigue is the obvious outcome. This performance is dogged by the constant laughter of an allegedly live audience which laughs its head off at everything, even when it's not all that amusing. The LP record is sometimes a mixed blessing when filled with material that simply cannot sustain its own length. ■

NEW RANGE OF RESISTORS, CONDENSERS AND POTENTIOMETERS

WE HAVE JUST PURCHASED THE COMPETE STOCK OF RESISTORS, CONDENSERS AND POTS. OF A LARGE MANUFACTURER AND CAN OFFER SAME AT LESS THAN 25 PER CENT OF LIST PRICE.

The resistors are mainly I.R.C. and Morganite and are in a wide range of values from 200 ohm. to 3meg. in ½, 1 & 2watt also included are I.R.C. 3watt wire wound 2,200 ohm. 3,300 ohm 4,700 ohm. etc.

List price **$9.00** per 100 our price **$2.00** per 100 post & packing 25c extra.

The condensers are in most popular makes and include Polyester, Paper, Mica, Ceramic & Electrolytic in standard values including 4mfd, 8mfd, 16mfd 300V etc.

List price **$11.00** per 100 our price **$2.00** per 100 post & packing 50c extra.

The potentiometers are all current types and include switch pots, dual concentric, 1meg. tandem, ½meg switch, tab pots etc.

List price **$12.00** per dozen our price **$2.50** per dozen post & packing 50c extra.

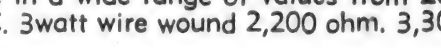
FREE With each lot of resistors, condensers or pots, we will supply free one new valve type 6U7G, 6X5GT, 1T4, 6K7G, or 12AT7. Resistors, condensers and pots are in packs of 100 or 12 and we regret we cannot supply to individual Lists of values or types.

NEW SELENIUM RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volts, $4.75. Post, N.S.W., 75c; Interstate $1.00.
As above, 6 or 12 volt, at 2 amp., $2.75. Post, N.S.W., 35c; Interstate, 45c. Transformer for above, $3.75. Post, N.S.W., 35c; Interstate, 45c.

TRANSISTORISED SIGNAL INJECTOR $5.75

A MUST FOR QUICK TROUBLE SHOOTING Using TWO Transistors, complete with instruction sheet and battery. Post free.



NEW VALVES AT BARGAIN PRICES

7193	25c	1T4	45c	6H6G	35c	6SS7 equiv. 6SK7	85c
807	$1.75	3Q4	75c	6K7G	45c	6U7G	45c
1C7G	30c	3S4	$1.00	6K8G	68c	6X5GT	75c
1D8GT	95c	5V4G	$1.00	6SA7GT	95c	7C7	35c
1K8G	40c	6C8G	50c	6SJ7	95s	12AT7	$1.00
1K7G	49c						
1M8G	40c						
1P8G	25c						
1Q8G	25c						

JA7GT	75c
1L5G	95c
12SK7	80c
12A6	80c
12K8	50c
12SH7	80c
866	1.50
954	25c
955	25c
EK32	68c

Please add postage on all valves.

NEW ENGLISH and AMERICAN TRANSISTORS AT 1/4 LIST PRICE

Ideal for the experimenter or service man.
Each package of 12 contains 3 of each of the following types.

PACKET OF 12 FOR $3.00

Mazda XA101.	Equivalent:	OC45 R.F. Transistor.
Texas 2N1108.	"	OC44 OSC. Transistor.
Texas 2N1111.	"	OC75 General purpose
Texas 2N1110.	"	OC45 R.F. Transistor.

THESE TRANSISTORS CAN BE SUBSTITUTED FOR MANY OTHER TYPES.
Post and Packaging 20c extra.

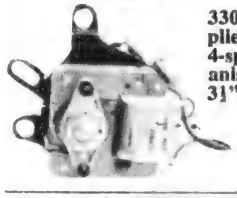
New Electrolytic Condensers

These condensers are miniature pigtail type insulated new stock in packets of 12, each packet containing; 3 16mfd 300 V.W., 2 32 mfd. 300 V.W., 1 25 mfd. 450 V.W. and 6 low voltage electrolytics. **$2.50.**
Post and packing 20c extra.

NEW IMPORTED 4" P.M. SPEAKERS

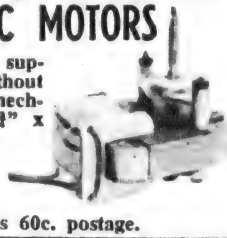
Available with a 4 or 16 ohm voice coil. **$2.00.**
Post and packing 30c extra.

NEW 240V ELECTRIC MOTORS

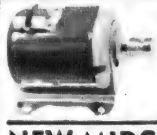


3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¼" x 3¼", including spindle.

$2.75



plus 60c. postage.



NEW MINIATURE MOTORS

Ideal for models, toys, etc. 1½ to 3 volts. 6,000 r.p.m. 39c each or $3.50 per doz. Post 10c.

NEW MIDGET POWER TRANS. $3.25

40mA prim., 240v. Sec 225 x 225 with 6.3v Fil. Winding. 30mA 240v Prim. Fil. Winding. **Postage: N.S.W. 25c; Interstate 45c.**
150 x 150v. Sec. with 6.3v. **Postage: N.S.W., 35c, Interstate 60c.** **$3.25**

NEW AMERICAN TWIN TELESCOPE TV AERIAL Extends to 36in, each section can be used singly for car or portable . . . . . **$1.50.** Post 20c.
SINGLE TELESCOPIC Aerial 12in extends to 33in. 60 cents .Post 10 cents.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools, 2 Track, $35, 4 Track $40.

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October Electronics Australia complete with kit of parts including transistors mono **$7.50,** stereo **$13.00,** 240 power supply for above **$7.00.**
Please specify if required for pick-up or tape heads.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

NEW TRANSISTOR 8 KIT SET

SPECIAL PURCHASE ENABLES US TO OFFER THIS KIT SET AT $24.00

DIMENSIONS
9" x 5" x 3" DEEP

(WIRED AND TESTED $6.00 EXTRA)

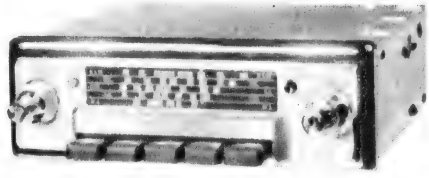
- Complete kit of parts with circuit and full instructions
- Eight transistors.
- Magnavox 5X3 speaker gives excellent fidelity.
- High sensitivity, suitable for city or country use.
- Heavy duty battery for economical operation.
- Modern design, plastic cabinet with gold trim.
- Dial calibrated for all States.
- Available in colours of off-white, red, black or light green.

Post & Packing extra. N.S.W. $1.25, Interstate $1.75.

NEW TRANSISTOR CAR RADIO

New transistor six car radios with R.F. stage, of Aust. manufacture using A.W.A. components and transistors.
Available in manual or push-button models with dial calibrated for all Australian States.
Supplied with speaker (5", 6", 5" x 7" OR 6" x 9") and lock-down aerial.

MANUAL MODEL $43.00
PUSH-BUTTON MODEL $48.00
Post and Packing N.S.W. $1.50, Interstate $2.50.

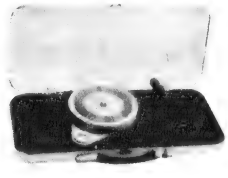


Suitable for 6 or 12 volts for positive or negative earth. Please state type required.

NEW TRANSISTOR STEREO RECORD PLAYER

$38.00

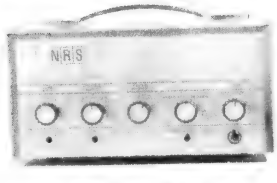
This Stereo Record Player is fitted in a durable and attractive vinyl covered case with silver trim and incorporates an 8-transistor Stereo amplifier with two Magnavox 5in x 3in speakers and B.S.R. record player (4-speed) with crystal pick-up. For 240 volt A.C. operation only. DIMENSIONS:— 21" x 10" x 3½" WEIGHT 12lbs



Post and Packing extra N.S.W. ..... $1.50 Interstate $2.50

NEW 25 AND 35 WATT. P. A. AMPLIFIERS

THESE AMPLIFIERS ARE SUITABLE FOR INSTALLATION IN CLUBS, SCHOOLS, RESTAURANTS, HOTELS, FACTORIES, ETC., WHEREVER THE AMPLIFICATION OF SPEECH OR MUSIC IS REQUIRED.



STANDARD AMPLIFIER

25W $61.00 SPECIFICATIONS 35W $71.00

Nominal power 25 or 35 watts. ● Inputs two microphone and pick-up or radio with separate controls and mixing facilities. ● Tone control. ● Microphone sensitivity 6MV. pick-up or radio 150MV. ● Frequency response 30 to 18,000 CPS. ● Output impedance Line output (100, 166, 250, 500 ohms) or can be supplied with V.C. output (2, 3, 7, 8, 15 ohms). ● Dimensions 11in x 6in x 8in. Weight 25W 23lb. 35W 26lb.

SEPARATE BASS AND TREBLE CONTROLS

AMPLIFIER WITH BASS and TREBLE CONTROLS

All amplifiers can be supplied fitted with a separate tone control stage with separate bass and treble controls and stand-by switch at $5.00 extra.
All amplifiers are too heavy to be sent by parcel post so can be sent by air freight or rail or road transport.

FREIGHT EXTRA.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

Signals from Europe — a six-monthly survey

Our six monthly survey of signals from Europe shows the usual increase in activity during darkness, and extensive use of the higher frequencies. This list of best-received signals should help new comers to the short-wave field.

ALBANIA: Radio Tirana has extensive services in English, and can be received as follows:

GMT	KHz
0630-0700	7265, 9510
1100-1130	9510
1930-2000	11905
2030-2100	7295

AUSTRIA: Radio Austria, Vienna, has a transmission to New Zealand and Australia which is on the air in French, German and English, on odd dates of the month, 1000-1200 GMT on 17885KHz.

Other transmissions well received include:

GMT	KHz
1200-1400	15325
1400-1600	17775
1700-2000	9610

BELGIUM: Radio ORU in Brussels has recently introduced some English periods in its transmissions. English programs are:

GMT	KHz
2205-2215	6010, 9615, 15335
0050-0100	6010, 6125, 11885

The transmissions best received in the Pacific are those in French and Dutch beamed to Africa, as follows:

GMT	KHz
1000-1215	21525, 17860, 15335
2115-2205	6010, 9615, 15335

BULGARIA: Radio Sofia, Bulgaria, has several daily transmissions in English, which are not specifically beamed to the Pacific, but can be received here. The best transmissions are:

GMT	KHz
1930-2000	6070, 9660
2130-2200	6070, 9660
0400-0430	9700

CZECHOSLOVAKIA: Radio Prague has a daily service to Australia and New Zealand. Many of its other programs to other parts of the world are also well received. The present services we suggest are:

GMT	KHz
0700-0800	6055, 9505, 9575, 11800, 15310, 21450, 21700
0330-0430	5930, 7345, 9540, 9630, 11990
1200-1230	9560, 11960, 15285
1900-1930	5930, 7345

DENMARK: Radio Denmark, in Copenhagen, has English for the Pacific area:

GMT	KHz
0815-0845	15165

Other services include:

GMT	KHz
1245-1315	15165
1915-1945	15165

FINLAND: Radio Finland, from Helsinki, is received at times in its English transmission at 2100-2200GMT, beamed to Europe on 6120KHz. Reception has also been observed at 1215-1315GMT on 15185KHz. On Friday a further transmission is 1600-1700GMT on 15185KHz. The frequencies of 9610, 6120KHz have been heard at sign-on at 0600GMT, and at 1000GMT on 15185KHz.

FRANCE: ORTF, in Paris, has programs in English as follo vs:

GMT	KHz
0515-0530	11970, 9700
1300-1330	15245, 17740
1915-1930	15245, 21580

GERMANY (Federal): Cologne, with the transmissions of Deutsche Welle, is on the air to Australia and New Zealand in English:

GMT	KHz
0845-0940	11785, 15275, 17845, 21650
2110-2200	7290, 9765, 15275

Broadcast in German to the Pacific:

GMT	KHz
0645-0945	9650, 15205, 21585

GERMANY (East): Radio Berlin International, Berlin, has its Pacific service:

GMT	KHz
0645-0730	21465
1115-1200	21540
1200-1245	17880, 21540

GREAT BRITAIN: The B.B.C. World Service is on the air 24 hours a day, and has three periods of reception especially for the South Pacific.

GMT	KHz
0600-0915	7150, 9640, 11955
0900-1115	15070, 17790, 21550, 25710
2000-2245	9410, 11750, 15070, 15260

GREECE: Radio Athens, Greece, has a few periods of English in its present transmissions, which are, in the main, in Greek and not intended for distant reception. En lish is as follows:

GMT	KHz
0700-0710	7295, 9605, 11720
1340-1350	7295, 9605, 11720
1945-1955	7295, 9605, 11720

HOLLAND: Radio Nederlands, Hilversum, has extensive services and its programs to the Pacific include English and Dutch. The English service is:

GMT	KHz
0730-0820	9525, 9715, 11730 (Mon.-Sat.)
0600-0720	6020, 9715 (Happy Station), (Sunday)
0730-0850	9525, 11945 (Happy Station).

Dutch programs are:

0600-0720	9525, 11730
0830-0950	9715, 11730

HUNGARY: Radio Budapest, Hungary, has an English service to British and North America:

GMT	KHz
2130-2230	5902, 6234, 7100, 7220, 9833
0430-0500	6234, 7220, 9833, 11910
0800-0815	11910, 15160, 17795 (Wednesday only).

ITALY: Rome Radio has a service to the Far East in English which is at times received at good level. Its special service in Italian for Australia always provides a reliable signal.

GMT	KHz
2200-2225	9710, 11905, 15310
2025-2045	9575, 11800, 11905
1935-1955	7275, 9710, 11810

Programs in Italian for Australia:

0600-0645	11810, 15330, 17795, 17820, 21560

LUXEMBOURG: Radio Luxembourg has programs in French and Dutch, which can be heard on 61900KHz under the Sydney sttaion VL16. English programs are presented between 2400-0200GMT at a time when reception is not possible. Best reception of the signal is around 2000GMT and again at 0600GMT.

MONACO: Trans World Radio, Monte Carlo, is received well on 7290KHz, with its gospel programs at 0630GMT. On Saturday the DX Special is received at 0610GMT. The station broadcasts in most European languages and uses many frequencies for these programs.

NORWAY: Radio Norway, Oslo has a 30 minute program each Sunday in English, following the first hour of the program which is in Norwegian. The services best received are as follows:

GMT	KHz
0700-0830	11735, 21730, 25900
1100-1230	11850, 21655, 25730, 25900
0300-0430	9550, 9610, 9645

BONAIRE 300KW TRANSMITTER TESTS

An extensive schedule has come to hand from Radio Nederlands, Hilversum, Holland, giving details on the tests to be carried out on the new 300KW transmitters to be located at Bonaire in the Netherlands Antilles. The first transmitter is due to test this month, and the following schedule of the transmissions has been released.

GMT	KHz	Language
2130-2220	17810	English
2330-0030	6085	English
0030-0100	6085	English
0100-0130	6085	Dutch
0230-0350	11730	Dutch
0400-0450	11730	Spanish

The OS25 has set new standards for a low cost, dual trace oscilloscope. It is rugged, simple to operate and maintain and is attractively styled. Triggering facilities are unusually comprehensive for a low cost instrument of this type and include internal triggering from either channel.

This oscilloscope has a vertical amplifier bandwidth from DC to 5MHz with a maximum sensitivity of 100mV/cm on each channel. The time base gives sweep speeds from 1 sec/cm to 0.5μS/cm using switched and fine controls. The operating mode best suited to the time base speed is automatically selected by the time base range switch; beam switching for the two slowest speeds and alternate sweep for the four highest speeds.

A bright clear display is obtained on a 5 inch helical PDA tube operating at a potential of 3kV overall.

5 MHz Dual Trace Oscilloscope OS25

$225 plus Sales Tax

EXCLUSIVE AUSTRALIAN DISTRIBUTORS FOR . . .

ADVANCE INSTRUMENTS

jacoby, mitchell & co. pty. ltd.

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MELBOURNE	ADELAIDE	BRISBANE	PERTH	LAUNCESTON
30-2491/2	53-6117	2-6467	28-1102	2-5322

POLAND: Radio Warsaw is best received in its service to the United Kingdom in English:

GMT	KHz
0730-0800	9570, 9675, 11840, 15275
1930-2000	6005, 7135, 7125

PORTUGAL: Emisora Nacional at Lisbon services include some in English which give good reception in Australasia:

GMT	KHz
0730-0900	17880, 21495
0345-0430	6025, 9680, 11934

ROMANIA: Radio Bucharest has several English services. None are specifically for this area, but can be received under favourable conditions.

GMT	KHz
1930-2030	5990, 7195
0300-0330	6150, 6190, 9510, 9570, 9590, 11810, 11940
0430-0500	6150, 6190, 9510, 9570, 9590, 11810, 11940

SPAIN: Radio Nacional Espana, Madrid, has few English programs, but those being received are:

GMT	KHz
2020-2050	9360
0300-0345	6130, 9760

SWEDEN: Radio Sweden, Stockholm, has several services in English which are received at good level:

GMT	KHz
1100-1130	9625
1230-1300	9760
2045-2115	9625
2245-2315	11810
0330-0400	11705

SWITZERLAND: The Swiss Broadcasting Corporation in Berne has a transmission daily in English for Australia and New Zealand. Others well received are also listed.

GMT	KHz
0700-0800	9590, 11775
0845-0945	11775, 15135
1000-1700	15305 17855 21520
0445-0545	6120, 9720

U.S.S.R: Radio Moscow has English transmissions for all parts of the world, and services to the Pacific are received on medium and short waves:

GMT	KHz
1130-1200	620, 9750, 17820
1200-1400	620, 1475, 9750, 15130, 15330, 17820

VATICAN: Radio Vatican has two services in English for the Pacific:

GMT	KHz
1130-1145	17830, 21690
1830-1900	6100, 7200
2200-2215	9670, 11745

YUGOSLAVIA: Radio Belgrade has programs in English as follows:

GMT	KHz
1530-1600	7200, 15240
2000-2030	6100, 7200
2200-2215	6100, 7200, 9500

VOICE OF AFRICAN BROTHERHOOD

English broadcasts have been received from the "Voice of African Brotherhood" operated by the Congo Radiodiffusion-Television Nationale at Lubumbashi. The station has an English hour between 1900 and 2000GMT, on 11865KHz. Up to 1930GMT the frequency is blocked by Radio Sweden, Stockholm, which is also broadcasting on this channel in English to Africa. At 1930 the Congo station has five minutes of news in English, followed by recorded music. At 1958GMT the news headlines are presented and the English transmission concludes. At 2000 the familiar drum beats are broadcast followed by announcements in Congolese and English and then a program in French is presented. This transmitter is at the former Elizabethville, and was for many months the Voice of the Congo during the Civil War in that country.

RADIO QATAR VERIFIES

A letter confirming reception has been received from E. T. Wrathall, the Chief Engineer of Qatar Broadcasting Service. The address is P.O. Box 1414, Doha, Qatar. The station operates on 9570KHz with the power of 100KW. A report from southern New Zealand was a matter of great interest to the station.

The transmission schedule at present is: GMT.

0330-0500, daily
1400-1730, daily
0330-0700, Fridays.

All programs are in Arabic and the station verifies reception in 20 days.

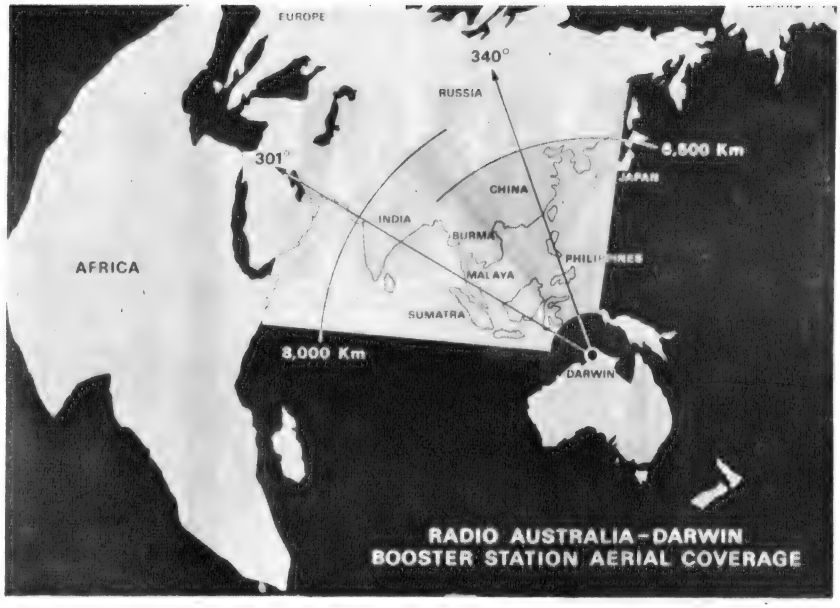
NEWS FROM ANGOLA

"A Voz de Angola" is a newly inaugurated network of Emissora Official de Angola, broadcasting in Kikongo and Portuguese as follows:

GMT	KHz	KW
0500-0700	1367	10
1100-1300	6175	100
1100-1300	9660	100
1700-2000	6175	100

Radio Commercial de Angola now operates on a new schedule:

GMT	KHz
0600-0900	4795
1100-1300	4795
1600-2400	3955



DARWIN BOOSTER FOR RADIO AUSTRALIA

The effectiveness of Radio Australia broadcasts to the areas north and north-west of Australia will be increased when a new high-power, high-frequency broadcast station under construction near Darwin is completed in 1969.

The high-power station complex is being established on the Cox Peninsula, some six miles north west of the Darwin township. When completed, the station will be the highest powered in Australia and will rank in size and radiated power with high-power stations in other parts of the world. The cost of the station is estimated as between $8 million to $9 million, divided almost equally between the radio engineering works and the site works, including roads, power supplies and buildings. In addition to the transmitting station, a receiving station will also be built, situated eight miles east of the transmitter site.

Initially, the signal from Shepparton will be picked up at the receiving station and relayed to the remote transmitting station via a radio bearer system. Although every modern receiving technique will be employed, including space diversity reception, it is expected that ionospheric conditions will adversely affect the Shepparton signals at Darwin for a small percentage of time. At a later date, it is anticipated that program material to the transmitting station will be fed from Melbourne over the proposed microwave broadband bearer through Mt. Isa.

EQUIPMENT: The two receiving aerials are vertically polarised log periodic types designed and manufactured by Co-el of Italy, for optimum performance on the Darwin-Shepparton path, with high front-to-back ratios to minimise cross-fire from the nearby 250KW transmitters, as well as interference from existing high-power transmissions in areas north and north-west of Darwin. The outputs of these aerials are fed to four diversity receiving terminals manufactured by Racal Electronics of U.K. The output of the diversity receiving terminals is monitored and selected by an operator for relay to the transmitting station via a microwave system manufactured by Radio Corporation of America. This microwave system loops the program through Darwin to permit the Australian Broadcasting Commission to monitor and insert program material if necessary.

The transmitting installation will comprise three American built Collins Model 821A-2 high-frequency transmitters, each capable of delivering a power output of 250KW. These transmitters represent the latest advances in broadcasting technology and embody extensive solid-state circuitry.

MALDIVE ON 4740KHz

Reception of the Maldive Broadcasting Service has been noted on 4740KHz to close down at 1730GMT. Before this time the station has a program of light music of a popular nature, and this is played without announcements until 1729GMT. At this time an announcement in English by a lady speaker gives the time and frequency in use and concludes the program. This is followed by the National Anthem which ends the transmission. Reception is fair in New Zealand, but the signal quality is spoilt by morse on the frequency, which makes the readability difficult.

As well as the music programs, the station has also been heard with Gospel transcriptions on some mornings, to sign-off. Further announcements from the station indicate that the English period is from 1515 to 1730GMT.

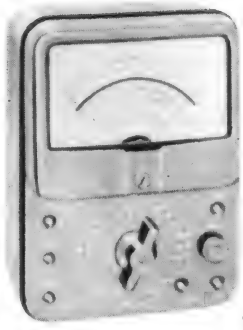
VERIFICATIONS RECEIVED

SIERRA LEONE: This is a very rarely heard station in Australia; however, it has been verified recently by Robert Shepherd,

SANWA

SANWA ELECTRIC INSTRUMENT CO. LTD.

HIGH SENSITIVITY MULTI TESTERS



MODEL 430 ES
$52·30
INCL. S.T.

100,000 OHMS/VOLT

This unit has a 10 microampere movement giving sensitivity of 100k ohms/volt for all DC ranges to 300 volts. The movement is supported by spring backed jewels and is protected by a parallel diode. Frequency response is to 100 KHZ

MEASUREMENT RANGES:

DC Voltage: 0.3v-3v-12v-30v-120v-300v (100kΩ/v)
1.2kv-6kv-30kv (with probe) (16.6kΩ/v)

DC Current: 12ma-0.3ma-3ma-30ma-300ma-1.2a-12a-300mv

AC Voltage: 3v-12v-30v-120v-300v-1.2kv (5kΩ/v)

AC Current: 1.2a-12a

Resistance: Up to 50 megohms (40 ohms to 400k ohms midscale)—decibel scale is provided

MODEL EM700
$117
INCL. S.T.

12 MEGOHMS

A high sensitivity circuit tester using field effect transistors to provide 12 megohm input impedance on DC and 1 megohm on AC ranges. It has wide frequency response and internal self-calibration facilities are provided.

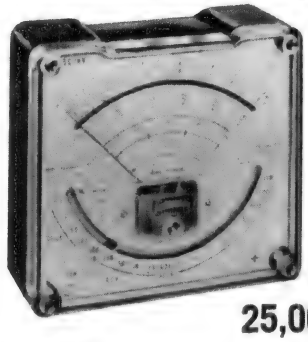
MEASUREMENT RANGES:

DC Voltage: ± 0-0.3v-1.2v-3v-12v-30v-120v-300v-1200v
± 0-30kv with HV probe used jointly
Internal resistance — 10mΩ for 0.3v/12mgΩ for other ranges

DC Current: ±0-0.03μa-0.1μa-10μa
± 0-1.2ma-12ma-120ma-300ma
} Terminal voltage—300mv

AC Voltage: 0-1.2v-3v-12v-30v-120v (on X1 range)
0-300v-1200v (on X10 range)

Resistance: 0 to 1000 megohms (75 ohms to 7.5 megohms midscale)—decibel scale is also provided.



MODEL F80 TRD
$32·60
INCL. S.T.

25,000 OHMS/VOLT

A unit with a 34.5 microampere movement and 25k ohms/volt sensitivity. It has a taut band suspension which will withstand impact and vibration. Ranges are smoothly changed over by a unique design rotary-ring switch. The meter movement is automatically protected from accidental impression of high current. The L1 and LV scales provided check all types of semi-conductors. The germanium diode rectifier extends frequency response of the low AC voltage ranges up to 100k cycles. Even the AC volt range checks voltages of 20k cycles.

MEASUREMENT RANGES:

DC Voltage: 0.25v-2.5v-10v-50v-250v-500v-1000v (25kΩ/v)

AC Voltage: 2.5v-10v-50v-250v-500v-1000v (5kΩ/v)

DC Current: 40μa-0.5ma-5ma-50ma-500ma

Resistance: From 100 ohms to 250k ohms midscale in 4 ranges

Load Current: L1-15ma-1.5ma-150μa

Load Voltage: LV-1.5v

Volume Level: —10~+10db-+5~+36db

AVAILABLE EX STOCK FROM

WF **WARBURTON FRANKI**

ADELAIDE: 56-7333. BRISBANE: 51-5121.
HOBART: 2-1841. LAUNCESTON: 2-1318.
MELBOURNE: 69-0151. MT. GAMBIER: 2-3841.
NEWCASTLE WEST: 61-4077. PERTH: 8-4131.
SYDNEY: 29-1111. WOLLONGONG: 2-5444.

WF130/68

Glen Iris, Victoria. Verification was by prepared card, signed by M. S. Finney, Supervising Engineer, which was received in three months. The report was sent in English for the frequency of 3316KHz at 2115GMT. Mint stamps were sent with the report. The resulting verification arrived by airmail.

COLOMBIA: Radio Nacional recently verified an English report in 1¼ months by airmail for a report of reception of 4955KHz, says Robert Shepherd, of Glen Iris, Victoria. Mint Colombian stamps were sent with the report together with a postcard, and the resultant verification was in the form of a personal letter in Spanish.

PERU: Radio Victoria at Lima verifies correct reports for 6020KHz by QSL card, reports Bob Padula, Melbourne, Victoria. The card shows a view of the station building. The date was given, but no other details and although the card is not signed, it is indicated that it was issued by Jose Eduardo Cavera A., the Gerents Director The station should be reported in Spanish with one or two IRCs included. The reply comes by airmail in 15 weeks.

BOLIVIA: A verification letter and card has been received from CP75 La Cruz del Sur at La Paz, using the new frequency of 5025KHz. The letter is signed by Hazen C. Parent, and the address is Cajon 8, La Paz, Bolivia. The station also operates CP27 on 730KHz, CP75 on 5025KHz and CP39 on 11765KHz. The frequency of 5025KHz is only temporary and replaces 4985KHz.

RADIO NEW ZEALAND SCHEDULE

The present schedule of Radio New Zealand, Wellington is as follows:

To the Pacific Islands:

GMT	KHz
1700-1945	9520, 11780
2000-0545	15110
0600-0845	9540, 11780—
To Australia	
2000-0545	17770
0900-1145	9520, 11705
To Antarctic	
0815-0845 (Sun)	9520

SOMETHING FOR NOTHING

Radio Nederlands, P.O. Box 222, Hilversum, Holland offers a wide range of data sheets and courses in various radio subjects, free to its listeners. Details of al these are listed in a "DX Information Service Catalogue," which is obtainable from the station, but below we summarise some of the items available to listeners from Radio Nederlands, in its "DX Juke Box" program.

Data Sheets.

Selectivity Improvement
Q-Multiplier.
Image frequencies
Beat Frequency Oscillator
Transistorised Crystal Calibrator.
Product Detector
Frame Aerial
Medium wave
This is DXing.

Technical Courses

Radio Nederlands Technical Courses previously broadcast in "DX Juxe Box" proved so popular that it was decided to re-issue them in the form of postal tuition. The following are available and enrolment is accepted for one course at a time:

Transistor Course
Shortwave Propagation Course
All Round DXers' Course. This course aims to cover the entire field of DXing, including its specialised branches, Utility DX, Maritime Mobile DX, Standard Frequency and Time Signal Station DX and other subjects. Other subjects covered are, Reporting, DX Codes, the SW broadcast bands, DX Equipment, SSB DX etc. The course was writen by Jim Vastenhoud, while the introduction to the series and the lesson on listening to stations in Asia was written by Arthur Cushen.

Condition for Enrolment

The lessons are sent in sets of four. Each following set is sent on receipt of answers to the few questions put at the end of every fourth lesson.

RADIO TARAWA VERIFIES

A verification letter has been received from the Gilbert Island Broadcasting Service, Betio, signed by the Assistant Broadcasting Officer, Mr Sione T. Kleis. The station is operating daily, weekdays 0700-0920GMT, Sunday 0700-0945GMT. A morning broadcast is on the air 1845-2000GMT Monday to Friday.

The medium-wave transmitters (VSZ1) operate on a frequency of 844KHz using the power of 50 watts. The aerial is a quarter-wave folded flat top "Tee." The shortwave station is VSZ2 on 4912KHz with a power of 2,500 watts. The aerial used is a 8-element vertical incidence array 40ft above ground and designed to cover the Gilbert and Ellice Island group only.

NEW SCHEDULES OPERATING

RADIO CANADA SCHEDULE

Broadcasts from Radio Canada, Montreal, are now being carried out as follows:

GMT	KHz	Area Served
0710-0805	9625, 5990	Africa
0825-0935	9625, 5970	Australia, New Zealand, S. Pacific
1055-1215	17820, 15320, 9625	Europe, N. Canada
1217-1313	17820, 11720, 9625	Europe, USA, Caribbean
1315-1343	21595, 17820, 11720	Europe, Antilles
1345-1515	21595, 17820, 15320	Europe
1516-1529	21595, 17820, 15320	Europe, N. Canada
1530-1630	21595, 17820, 15320	Europe
1631-1659	21595, 17820, 15320	Europe, N. Canada
1700-1830	21595, 17820, 15320	Europe, N. Canada
1832-1835	17820, 15320	C. Africa
1835-1950	17820, 15320, 11720	C. Africa, N. Africa
1950-1958	15320-11720	C. Africa, N. Africa
2000-2152	15320, 11720, 9610	Europe
2158-2250	15190, 11720, 9625	Europe, N. Canada
2258-0046	15190, 11945, 9625	South America
0058-0400	11720, 9625, 5970	N. Canada
0400-0557	9625, 5970	N. Canada
0557-0558	5970	N. Canada
0558-0630	9625, 5990, 5970	Europe, N. Canada
0630-0631	5970	N. Canada
0631-0706	9625, 5970	N. Canada

RADIO KABUL

The present schedule of Radio Kabul in Afghanistan is as follows:

GMT	KHz	KW	Language
1200-1300	21585	50	Pashtu, Dari
1200-1300	15415	100	Pashtu, Dari
1730-1800	15265	50	German
1730-1800	11775	100	German
1800-1830	15265	50	English
1800-1830	11775	100	English
1300-1400	4775	100	Urdu
1400-1430	4775	100	English
1430-1730	4775	100	Pashtu, Dari
1700-1730	7200	50	Russian
0200-0400	6000	50	Pashtu, Dari
0730-0830	6000	50	Pashtu, Dari
0200-0400	7200	10	Pashtu, Dari
0730-0830	7200	10	Pashtu, Dari
1130-1300	6000	10	Pashtu, Dari
1300-1700	7200	50	Pashtu, Dari
0730-0830	660	20	Pashtu, Dari
1300-1745	660	20	Pashtu, Dari
0200-0400	1280	100	Pashtu, Dari
1130-1830	1280	100	Pashtu, Dari

The medium wave stations are Kabul on 660KHz, Jakatut and Pol-E-Tscharchi on 1280KHz.

ENGLISH FROM STOCKHOLM

The present schedule of the Swedish Broadcasting Corporation is as follows:

GMT	KHz	Area Served
1100-1130	9625	Europe
2045-2115	6065	Europe
1600-1630	17770	Middle East
1900-1930	11865	Middle East
1230-1300	9760	Far East
2045-2115	9625	Far East
2245-2315	11810	Far East
1230-1300	21690	Africa
1900-1930	15240	Africa
1400-1430	15240	Asia
0515-0545	21675	Asia
1100-1130	11705	North America (East)
1400-1430	21675	North America (East)
0030-0100	5990	North America (East)
0200-0230	5990	North America (East)
1600-1630	15310	North America (West)
0330-0400	11705	North America (West)
2245-2315	11705	South America

MULLARD MAGNAVOX

BOOKSHELF ENCLOSURE
Maple, Teak or Walnut
Complete $24.75
SUPER BOOKSHELF $36.75.
Post: N.S.W. 50c. Interstate $1.00.
CABINETS ONLY
R. H. BOOKSHELVES $11.50
MULLARD $10.95
BOOKSHELF UNITS

6in	8in	10in	12in
$27.75	$33.50	$35.50	$36.50

GUITAR AMPLIFIERS

10-Watt, Two-Channel, with Twin Cone Speaker **$53.55**
14-Watt, 4 Inputs, Bass and Treble Boost. 2 Twin-Cone Speakers, **$63**
17-Watt, Four-Channel, Bass and Treble Boost. Two Twin-cone Speakers **$76.25**

35 WATT

4-Channel, Bass and Treble Boost. 4 Twin-Cone Speakers .. **$109.05**
Vibrato with foot control and 2 preset controls for frequency and intensity. **$10.50** extra on above models.

14 plus 14 WATT

With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb. Two 9 x 6 Woofer Speakers. Two 9 x 6 Twin-Cone Speakers. 4 Channels. Bass and Treble Boost. Foot Vibrato control included.

$163.50

SLAP BASS OR BASS GUITAR 40-WATT AMPLIFIER
4 Input Channels. Bass and Treble Boost. Two 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

$159.75

PIGGY BACK GUITAR AMPLIFIER

30 Watt **$79.75**
45 Watt **$99.75**
60 Watt **$119.75**
4 Inputs. Bass and Treble Boost. Vibrato if required, **$10.50** extra.

ELECTRIC GUITAR

Pickup Units $8.75
Accordion Pickup Units .. $8.75
Harmonica Pickup Units .. $1.95
Post, N.S.W. 40c; Interstate, 75c.

FUZZ BOX

FUZZ BOX E, AND A, AUG. WIRED AND TESTED, $15.
Post., 75c.

REVERB UNIT

COMPLETE with AMPLIFIER. E.A. October issue. Kitset $39.95. Wired and tested, $41.95.

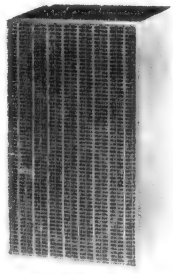
15-INCH HI-POWER SPEAKER

30 and 50-WATT RMS. Specially designed for Guitar, Organ, Bass, etc.

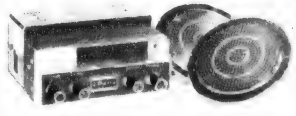
$30.00

INTER. COM. UNITS

2 Station Transistorised
$11.95
4 Station, including Master
$20.95



"MYERS" AUTOMOBILE STEREO TAPE PLAYER

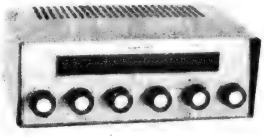


12 VDC, 1 amp operation. Size 3, 4 and 8 track cartridges can be played. Automatic starting and selecting. 12 silicon transistors. Freq. response, 70-10,000 cps. Tape speed 3¾" per sec.

$99.50

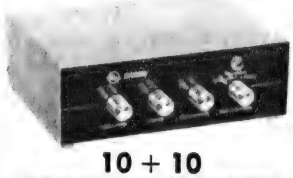
240 VAC model available, includes P.U. or radio input. $99.50

PLAYMASTER 106 AND 107



Feb. and March Elect. Aust.

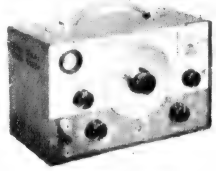
106
WIRED AND TESTED **$94.75**
107
WIRED AND TESTED **$83.75**



10 + 10 STEREO AMPLIFIER

E.A. November.

Kit Set **$59.75**
Wired and tested **$69.75**



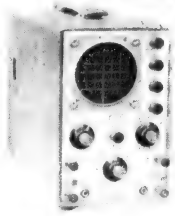
T. E. 46 RESISTANCE-CAPACITANCE

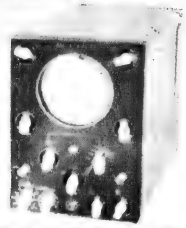
Bridge and Analyser. Capacity 20 pf to 2,000 mfd. Resistance 1 ohm to 200 megs. Also tests power factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.

Indications by eye and meter.

$49.75

TEST EQUIPMENT



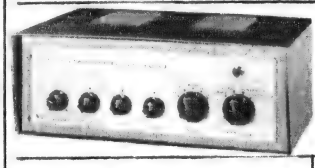


WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth Push-pull vertical and horizontal Amplifiers, 8 positions, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

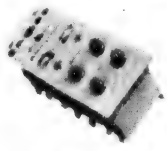
3-inch $102.75; 5-inch $118.75

T.O.2 TV AID $64.50



PLAYMASTER 115

The new solid state Stereo-Amplifier. April issue.
Wired and tested $104.00
Kit Set $90.00
Pre-amp to suit magnetic cartridge 12.00



119 STEREO TAPE ADAPTER

Suits all Playmaster Stereo amplifiers and others that accept crystal P.U.

Kitset $79.00
Wired and tested $96.00

TAPE PLAYBACK KITSET

BSR deck with parts for transistor pre-amp and circuit.

$30.00

Post $1.25 N.S.W., $2.00 Interstate.

Easy to build. Mi-Fi quality.

TAPE DECKS B.S.R.

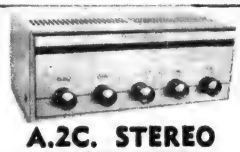
2 Track, 3¾ i.p.s.
$25.50
4 Track, 3 Speed Stereo.
$41.50

240v A.C. POWERED SOLID STATE STEREO

T.S.135

18 Transistor. 15-watt per channel. Inputs for Tape. Mag. P.U. Ger. P.U. Radio Aux. Frequ. Range 30c to 20KC. Max Sensitivity 3 MV. Speaker matching 4 to 15 ohms.

$78.00



A.2C. STEREO AMPLIFIER

5 WATTS PER CHANNEL.
Valve Unit. 240v A.C. Input for Crystal and Ceramic P.U. Radio and Auxiliary. Output for 4, 8, 15 ohms. Cross talk better than -40db. Sensitivity 50 MV.

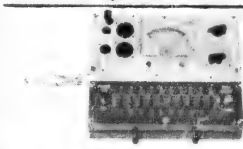
$47.50

UA 41A - 20-20

SOLID STATE STEREO

20 watts per channel. Inputs for tape, magnetic and ceramic P.U. Tuner and aux. Teak cabinet.

$88.00



VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts, Merit on direct reading. Good-bad meter. Complete with tube chart.

$27.75

Post., N.S.W., 25c; I'state, $1.25.

T.E. 50-99-5011

Checks, Nu Vistas, Compactrons, etc.

$34.95

Post: N.S.W. 25c; I'state $1.25.

G.D.O. UNITS

Post., N.S.W., 50c; I'state, 75c. T.E. 15 Transistorised, 7 Band, 360 Kc to 270 Megs.

$35.75

SOLID STATE VTVM

E.A., Dec.
Wired. Tested.
$49.50

AUDIO GENERATOR

De Luxe Model TE—22D.
Freq. range. Sine 20 cps—200 KC. SQ. 20 cps—25KC. Output voltage, Sine 7V. SQ. TV P.-P. Output impedance 1000 ohms. Acc. 5 per cent. Distortion less than 2 per cent. 4-range attenuation. 1/1, 1/10, 1/100, 1/1K. Printed circuit. 240V A.C.

$42.95

SIGNAL INJECTOR

Transistorised. Fountain pen-sized Unit for Signal Tracer in Radio, TV and Amplifier Service.
$5.75. Post, 25c.

TRANSISTOR AND DIODE TESTER

E.A. August, '68.
Wired and Tested.
$57.00
KIT SET $48.00

FEBC SEYCHELLES

A new relay station for The Far East Broadcasting Company is expected to commence testing in February from the Seychelles, following the arrival of a 3KW transmitter from the FEBC station at Okinawa. A report from the FEBC says that negotiations have been completed with the Government of the British Colony of the Seychelles, a group of 89 Islands in the Indian Ocean 1,000 miles east of Mombasa, East Africa, and 1,700 miles south-west of Bombay. The site of the station is near the capital town of Victoria, on the largest island. It is hoped that Phase 1, which includes the basic requirements for the transmitter, plus staff accommodation, will be complete, and the transmitter operational by February 1969. Phase 2 plans for a second transmitter to be in operation by December 1969.

NOTES FROM READERS should be sent to ARTHUR CUSHEN, 212 Earn St., Invercargill, N.Z. All times are GMT. Add 8 hours for Perth, 10 hours for Sydney and 12 hours for Wellington. All frequencies in KHz.

Infrared TV camera...

(Continued from page 27)

The present display, although fulfilling the original requirement of portablity and battery operation, does not make full use of the information content of the video signal. While adequate for a number of uses in which the movement and approximate positions of hot spots need to be examined, it suffers from two main disadvantages:

1. The actual measurement of temperature or relative temperature is very difficult on an intensity-modulated phosphor, even if known black body reference temperature sources are included within the field of view.

2. The location of objects within the field of view is sometimes very difficult The infrared image does not always bear a resemblance to the visible image.

One method of overcoming the first difficulty is to add the infrared video signal to the Y-deflection on a large display; that is, the frame timebase. This generates a Y-deflection of each line proportional to the signal from the detector. Thus besides providing more visual information content in that small temperature fluctuations are more easily seen, it also enables relative temperature differences to be accurately measured. An extra feature might be a facility for selecting a single line for closer examination. The contrast of the picture can be enhanced by a combination of Y-modulation with some brightness (Z) modulation.

Another method could use a colour-tube for the display. Then the temperature variations could be presented as changes of colour in the scene.

A third method of overcoming both the above difficulties might be to superimpose the low-definition infrared picture in colour onto a high definition normal black and white television picture. The high-definition picture would solve the location problem and would also have the effect of enhancing the optical resolution of the infrared picture.

("Mullard Technical Communications," Vol. 10, No. 93)

ANSWERS TO CORRESPONDENTS

When writing to us:—

- *Please give your name and full postal address, including the State and Postcode.*
- *Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.*

DEAD LETTER: We are holding a letter addressed to Mr E. Jones, 8 Hengin Street, Grey Lynn, Auckland, New Zealand. It has been returned marked "Not known by postman, Grey Lynn." Would the writer please contact us with details of correct name and address.

DEAD LETTER: We are holding a letter addressed to Mr G. Celarus (the signature is not very clear), 24 Flinders Crescent, Ermington, N.S.W. 2115. It has been returned marked "Unknown to postman at Ermington." Would the writer please contact us with details of correct name and address.

1959 TV RECEIVER: May I offer comment on the excellent endurance record of your 1959 TV Receiver? The set was constructed just on nine years ago and, apart from the spectacular demise of a 6DQ6, has performed perfectly ever since, without a single fault. It has seen about five changes of address and has been used for an average of two to three hours per night. Its longevity may be due to good luck but I would prefer to think that it is testimonial to the quality of the A.W.A. (mostly) components and the soundness of your design. Congratulations. **(B.W., Thornleigh, N.S.W.)**

● You may certainly make comment along those lines, B.W. As a matter of fact, the original receiver is still doing its stuff in the home of one of our staff members.

FLYING DOCTOR RADIO: Would you consider publishing a circuit for an SSB transmitter suitable for use on the Flying Doctor band? Sets must be changed to SSB by 1970, so there should be no great hurry. The present transmitters operate on three fixed frequencies with a maximum aerial power of 25 watts. The frequencies differ from station to station, so allowance would have to be made for this in the design. Power supply should be 12V DC. Could the transceivers be transistorised? I have built several of your projects and wish to commend you for a fine magazine with a good balance of material. **(P.T., Charters Towers, Nth. Qld.)**

● The specifications for equipment to be used for radio communication services are becoming progressively tighter and the basis for licensing is that all equipment shall have been type approved. The problems of constructing equipment in the home to meet the new specifications and of obtaining certification for it would appear to be such as to render it impractical. This is one area where there is little chance of being able to assist readers.

AUTOMATIC TAPE STOP: Have you published a means of switching off a tape when it is finished, and if so could you please tell me how to get it? **(G.C., Beenleigh, Qld.)**

● We published a Tape Actuated Relay in September, 1967, which should meet your requirements. Copies of the article may be obtained through the Information Service for 20c.

RECEIVER AND AMPLIFIER: Have you published any plans of a transistor short wave receiver of five or six transistors? Also have you published plans of a transistor amplifier using three transistors? **(G.W.C., Geelong, Vic.)**

● We published a three-band eight-transistor receiver in August, 1961, and a modified version of the same receiver in April, 1965. Otherwise, apart from beginners' two and three-transistor receivers, all our short-wave receivers have used valves. Our latest valve short-wave receivers were the 1967 All-Wave series using two to seven valves and published from June to December, 1967. We published a small two-transistor amplifier in June, 1961, but most of our later designs have been for stereo use, and as such have had a larger complement of transistors. Copies of each of the articles mentioned may be obtained through the Information Service for 20c each.

PHOTO TIMER: With reference to the circuit of "A Simple Photo Timer" on page 89 of the October, 1964, issue, I believe that the circuit as shown is a sure-fire transistor destroyer. Even if the first transistor withstands the energy stored in the 400uF capacitor, this capacitor is directly across the base/emitter diode and hence would discharge rapidly. The first transistor is saturated, so the second transistor would also suffer from excess base current. Both problems could be cured by inclusion of an emitter resistor in the first transistor. **(P.B.J., Bayview, N.S.W.)**

● What you say may well be true, P.B.J., but the circuit you mention was published on the "Reader Built It" page, and so is really the responsibility of the author, whose name and address is given. As we state on the title page of the "Reader Built It" section, these are circuits and devices which we have not actually tested in our laboratory, but which are published for the general interest of beginners and experimenters. In other words, this is a section of the magazine wherein readers can exchange ideas and, while we select those published on the basis that they have a reasonable chance of working, responsibility for the fine details, component tolerances, and so forth, rest with the contributor.

AMATEUR FRIEND: About six months ago I was given a short-wave receiver by a friend of mine, a licensed amateur with the call sign VK2ATM. I should like to get in touch with him to obtain some information about the circuit, but he has recently moved to Queensland and I do not know his whereabouts. Can you help me locate him. **(R.H., 73 Alma Road, Padstow, N.S.W. 2211.)**

● All we can do is publish this request in the hope that VK2ATM will see it and get in touch with you.

MORE AMATEUR GEAR: Congratulations on your excellent magazine. I always find many interesting articles in each issue, but I do have two complaints. I would like to see more projects for amateurs, perhaps a transistorised communications receiver, a little more elaborate than the all-wave series. And how about a transistorised SSB exciter? If this is impractical, could you start a regular feature "Useful Transistor Circuits" in which small circuits, such as a BFO, could be featured for those who wish to design their own equipment. Another minor complaint: in hi-fi projects, the size of the case is not given, and this is annoying for those who wish to make their own case. Can you advise the size of the cases used in the Playmaster 123 Program Source (October, 1968) and Playmaster 115 Amplifier (April, 1967). **(M.G.L., East Kew, Victoria.)**

● Thank you for your complimentary

"ELECTRONICS Australia" Information Service

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

REPRINTS: For a 20c fee, we will supply circuit data, as available from our files. The amount of data available varies but in no case does it include material additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuit data will be answered more speedily if the circuits are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c PER PAGE.

PHOTOGRAPHS, DYE-LINE PRINTS: Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, metalwork dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs but give no details of wiring.

BACK NUMBERS: A fairly good selection is available. On issues up to 6 months old there is a surcharge of 5c. On issues from seven to 12 months old the surcharge is 10c. Over 12 months, it is 20c. Package and postage is 10c extra in all cases.

REPLIES BY POST: This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last 12 months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by telephone.

COMMERCIAL EQUIPMENT: "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design. "ELECTRONICS Australia" does not deal in electronic components. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

REMITTANCES: These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

ADDRESS: All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia," Box 2728 G.P.O., Sydney, N.S.W., 2001. Other correspondence should be directed to The Editor.

9/67

SOUND PROJECTORS

Cinevox Prefect and Hamour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.

from $90

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included. **$1.25 each**

Post 10 cents.

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1¼in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule,
1 Lampholder. **$1.85**

Post.: N.S.W., 30c: Interstate: 40c.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$23.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

Please note we are now able to include ½ mile of telephone cable FREE with each set of Phones.

BATTERY CHARGERS

240 volt A.C. Input.
Each Battery Charger will charge either 6 or 12 volt batteries.

2 amp, without meter,	$13.75
2 amp, with meter,	$15.75
4 amp, with meter,	$19.50

Post N.S.W. 70c, Interstate 95c.

MINIATURE ELECTRIC MOTORS

1½ to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only
65 cents each or 10 for $4.00
(Post 7c)

TRANSCEIVER

(2-way radio) R.C.A. America RT 68. 24 volt. operated 10 watt output 38-54 meg/cycles F.M. crystal locked. Transmitter and receiver using frequency synthesiser in 100 K/cs. step 10 channel per meg/cycle with power supply, Leads, mike and headphones $90.00. 60c cartage to rail. Freight payable at nearest attended railway station.

TRANSCEIVER

(2-way radio) 62 set ideal small ships, Hams, etc 1.6 to 10 megs. Crystal locked or V.F.O. controlled 5 watt output. Complete with antenna, headphones and mike but not air tested. $60, air tested $90. Not tested incomplete (without accessories $25). 60c cartage to rail. Freight payable at nearest attended Railway Station.

HEAD PHONES

Low impedance moving coil fitted with rubber muffler to reduce external noise, fitted with press to talk, dynamic hand microphone, ideal for use with all types of transceivers. $3.50 pair. Same with black felt muffler, $4.50 pair.
Post. N.S.W. 25c; Interstate 30c.

RECORDING TAPE SPECIALS

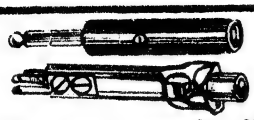
EMI TAPE at a fraction of the Retail Price, direct from one of Australia's leading Broadcast studios.
Used in good condition.
1,800ft, 7in spools, $2.75, post 25c
900ft, 5in spools, $1.60, post 20c
300ft, 3in spools, 60c, post 13c

MINIATURE CRYSTAL EARPHONE

With Cord and Plug. 75c Post. 4c.

16 FT. WHIP AERIALS

4-Piece, brand new. $3.75. 60c cartage to rail. Freight payable at nearest attended railway station.



P.M.G. Phone Jack and plugs, 25c each, 45s the pair.
Post 7c.

NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

$1.00 each

Post, N.S.W., 25c; Interstate, 35c.
1.2 volts 18 AH, 8in x 4in x 2in, $3.95
2.4 volt 10 AH, 6in x 2½in x 2in, $2.50.
Post, N.S.W., 30c; Interstate, 40c.

WALKIE TALKIE TWO WAY RADIOS

P.M.G. Approved Citizen Band, 6 transistor $50 per set of 2.
9 Transistor, $75.00 per set of 2.
Post. N.S.W., 50c; Interstate, 60c.

P.M.G. TYPE KEY SWITCHES, 45c each. Post., 15c.

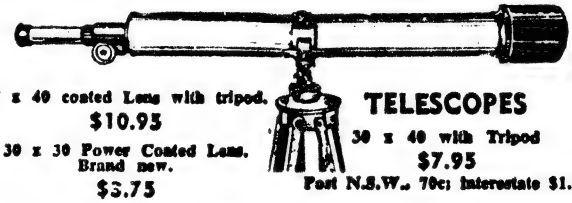
VALVES

BRAND NEW

IN CARTONS.
Special discount for quantity

807	75c	5BP1	$3.50
6SN7GT	95c	X61M	$2.25
89	$1.00	CV850	$1.50
12SA7	$1.25	1H6G	30c
5U4G	95c	832	$5.00
77	$1.00	6F13	75c
EF50	35c	6AK5	$1.50
6U7	75c	6X4	$1.00
V1103	$1.00	6F8	75c
VH120	75c	12SK7	50c
IL4	$1.00	VR1120	50c
5Y3	$1.75	VR118	75c
6C4	50c	VR65	25c
CV2184	$2.95	VT4C	75c
2 x 2	75c	AU5	$1.00
6AG5	90c	80	$1.25
12AU7	$1.00	6AK5W	$1.50

PLEASE ADD POSTAGE ON ALL ARTICLES



40 x 40 coated Lens with tripod.

$10.95

30 x 30 Power Coated Lens. Brand new.

$3.75

60 magnification with a 60mm coated objective lens. With tripod.

$23.00

As illustrated.
Postage, 95c; Interstate $1.20.

TELESCOPES

30 x 40 with Tripod

$7.95

Post N.S.W., 70c; Interestate $1.20

EX ARMY TELESCOPES

4 x 40 Handley	$6.50
7 x 40 Otway telescope,	$9.85.

Freight payable at nearest attended railway station.

HIGH STABILITY RESISTORS

I.R.C., brand new ½w., 1w, 2w, tolerance between 1 and not exceeding 5 per cent including 1K, 15K, 22K, 27K, 100K, 180K, 220K, 560K, 820K, ohms. Usual price 40c each, 50 assorted different values for only

$3.75 Post 15c.

522 TRANSCEIVERS

100 to 150 m/cs.

$35.00

TYPE S POWER SUPPLY

(240 Vac supply for AT 8-ARB) suit most types of Disposal transmitters and receivers outputs 250 volt, 10ma, 250 volt 200ma, 300 volt 100ma, $30.00.

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1,320ft coil of twin (equal ¼ mile). $7 per coil.
Post. N.S.W. 70c; Interstate $1.20.

SWITCH BOARD FRAMES

Steel ex-P.M.G. Height 45in x 27in x 34in, will make ideal test bench. $10.
$1.00 cartage to Rail.
Freight payable at nearest attended railway station.

SCOOP PURCHASE

Gramo. Motors. New. Made in U.S.A. 4-speed .240 volt A.C. 50 cyc. Only $2.75 each.
Post, N.S.W., 30c; Interstate, 40c.

CO-AXIAL SWITCH

70 ohms 4 positions can be motor driven completely waterproof 70 ohms type connectors. Housed in metal case 9" x 8" x 8" $5.00 each. Post N.S.W. 70c. Interstate $1.20.

C.M.A. CABLE

240 volt 3/.036 black, new and perfect. 100yd rolls $3.00; 6 or more.

$2.50

30c cartage to rail. Freight payable at nearest attended railway station.

MICROMETERS

Brand new Slocombe, 1in-2in, $7.85. Post, 32c.
VIBRATORS, 6 volts, 7-pin, 75c each.
UNISELECTORS, 4 BANK, $4.00 Post, N.S.W., 25c; Interstate, 30c.
INSTRUMENT TRIPODS, sturdy, wooden frame. Telescopic. Extend to 4ft 6in $13.00
SELSYN MOTORS MAGSLIP Mk. II .. .. $8.25 ea.

No. 19 TWO-WAY RADIOS
Sold as is without power supply, leads, accessories, etc. Only $15. Or complete with above gear, $35.

BINOCULARS

PRISMATIC. Coated Lenses.
Brand new. Complete with case.

6 x 30	$18.75
7 x 50	$22.18
10 x 50	$23.07
12 x 50	$23.95
20 x 50	$26.50

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3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils. $1.25 each.

MINE DETECTORS

Ex A.M.F. with Instruction Book. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station. **$39.00**

4 DIGIT RELAY COUNTERS

50-volt D.C., suit slot car, Lap counters, etc.
$1.25 each. Post 13c.

ALTEC STUDIO MICROPHONES

639B Western Electric, top grade, original cost $250. Ideal Broadcast Studio, music recording, Church and play recording, etc.
Fraction of original cost.
Price on Application.

240 VOLT 522 POWER SUPPLY

Supplies all necessary voltages to operate 522 transceiver from 240 VAC. Complete and ready to plug in, $30.00.

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2.00. We haven't got time to sort them, so you reap the benefit.
Post, 60c.

SOLENOIDS

Plunger Type 12V 300M.A. Suit electric camera control, miniature trains, radio, etc.
$1.25. Post, 10c.
200 Mill. amp., 24 volt, 1/8in push movement.
$1.25, Post 10c.

LENSES

TOP GRADE ACHROMATIC 2in DIAMETER, 20in FL, ideal as telephoto lens, telescope objectives.
$13.
Postage 46c.

CONDENSER LENS

2½in DIAM. 2in FL. $1.50 each or $2.50 per pair. Post 21c.

CONDENSER LENS

1½in diam.. 1½FL. 50c each.
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FOUR CHANNEL BRANCHING AMPLIFIER

With 4in Vu. meter GLORAD. Complete with Portable Power Converter, 600 ohm balanced input and output. Ideal for outside broadcasting, etc.

$39.50

MONITOR SPEAKER UNIT

Ex-A.B.C., consisting of low resistance 8in speaker in Acoustic Labyrinth Baffle Box, complete with 10-watt amplifier, 600 ohms plus 8dbm input, 240 volt A.C. operated.

$37.50

TEN CHANNELS VHF TRANSCEIVER

Types TR1934 100-125 meg/cys. and TR1935 125-150 meg/cycles. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

$33.00

CRYSTAL CALIBRATOR

With 500Kc crystal up to 32 meg/cycles.

$15.00

BENDIX BC221 FREQUENCY METERS

Built-in 240 volt power supply, perfect condition.

$90.00

AMPLIFIER

Subminiature 4-Transistor, Audio Push-Pull.

$7.00 Post 50c.

Deitch Bros.

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SORRY, NO C.O.D.

ANSWERS TO CORRESPONDENTS—continued

remarks. The type of major amateur project you refer to requires a great deal of development work, and there is a strict limit on how much of it we can cope with. Whether an effective receiver can be made up from independently devised stages is open to serious question, if this is what you have in mind. Incidentally, we published two articles in September and October, 1967, dealing with transistorised oscillators, including one circuit suitable for use as a BFO. About metalwork, we find that, although we did not give the actual size in the October, 1968, issue for the Playmaster 123, we did refer to the October and November, 1965, issues, where full dimensions were quoted (12¼ x 6¼ x 4¼in). The size of the case for the Playmaster 115 (12¼ x 4⅝ x 8¼in) was given as the first item in the Parts List, on page 67 of the April, 1967, issue. Full dimensional details of metalwork are available through our Reader Inquiry Service in dyeline form for the benefit of readers who wish to make their own metalwork.

CHEAP TEXTBOOKS: Can you tell me of any relatively cheap books which would be available from bookstores and which give circuits and parts lists for audio amplifiers and audio oscillators. I am interested in transistor circuits, not those using valves. **(D.J.M., North Adelaide.)**

● Unfortunately, there are a number of reasons why we cannot help with this type of query. One is that we have no knowledge of the technical standard of the individual concerned. Another is that we just do not have time to maintain all the information necessary on which to base such advice. We receive and review a fair percentage of new electronics textbooks appearing on the market, but this is not necessarily all that are available. And, even among those we do handle, it is virtually impossible to recall from several years past all the likely titles and contents or to know the stock position from time to time. The best we can do is to review books as we receive them, giving the most comprehensive and objective report possible, and leave the reader to make his own choice. The best step is for the reader to visit his nearest large bookstall or public library, where the particular book—and others on the same subject—may be examined.

When writing, please make sure your address is complete, including the POSTCODE. Addition of the latter will ensure minimum delay in handling your letter. Also make sure that your address is legibly written or, for preference, PRINTED. A significant number of letters are returned to us each month because the original address was incomplete or illegible.

CONTENTS REPEATED: I've been following your magazine for more than a year and found it of good quality but I would like to comment on the way you have published some of the articles. Referring to the All-Wave Receiver for 1967, and the more recent Playmaster 122/3 Program Source, you rather unnecessarily repeated the content of articles just to take in some modification or improvement. Why not just publish the modification and let interested readers refer back the preceding issues for the rest of the information? I would also like to request that a summary of specifications be given for all projects. **(S.O., Parkville, Vic.)**

● Although the All-Wave receivers were published as a series, they are the kind of receivers from which many readers will tend to select and build one as a complete project. The tendency to do this increases with the passing of time. This is when the problem arises, for individual readers, and for our query service, when the information relative to a wanted design has to be pieced together from a number of separate issues. We agree that there is room for objection to repeating material but, equally, a good case can be made for doing this very thing. We normally publish specifications for projects, such as amplifiers, where performance from unit to unit is likely to be consistent. With receivers, using a variety of coils and IF transformers, and transistors which are not group-selected, figures for sensitivity and selectivity of a prototype unit would not hold for those constructed by individual readers.

PROJECTS WANTED. Will you consider publishing an article dealing with the construction of an electric depilatory needle? I would like to know the principle of operation. Have you ever published anything about building an electronic insect killer? **(J.G., Port Kembla, N.S.W.)**

● The depilatory device you mention is a cosmetic instrument, and we do not feel this comes within the scope of our magazine. The insect killer uses very high voltages from a high impedance source to electrocute insects coming into contact with a wire mesh screen. The insects are lured by a light with a bluish hue which is said to be a wavelength which attracts them. The difficulties of obtaining suitable metalwork and specialised components are such that we can hold out little hope of featuring such a project.

WHY PUSH-PULL? I have been told that a push-pull circuit is the best compromise between maximum output power, minimum distortion and economy in components. Is this so? Have you published a circuit of this type for reasonably advanced people giving about four watts? **(M.W., Bellevue Hill, N.S.W.)**

● What you have been told about push-pull operation is basically correct. In fact, the advantages of this circuit are such that most amplifiers designed to deliver more than a few watts employ it. This includes our own circuit designs. While space does not permit a detailed explanation in these columns, some of the major advantages of the circuit are as follows: (1) Cancellation of odd harmonic distortion. (2) Cancellation of DC in transformer primary, making possible better transformer performance. (3) Improved efficiency, whereby two output valves are able to deliver more than twice the output of a single valve. In addition there are a number of minor advantages which apply in some, or all, cases. We have published a great many amplifier circuits, and could probably supply a suitable design if you care to advise the exact application, type of pick-up, etc.

STEREO AMPLIFIER: Within the last two years in your magazine you had details of a stereo amplifier suggesting the use of components most amateurs would have on hand. Can you help me to obtain this article, or circuit, or any suitable circuits you may suggest. **(P.K., Broken Hill, N.S.W.)**

● We published a Basic Stereo Amplifier in June, 1966; copies of the article are available through the Information Service for 20c.

INFRA-RED CIRCUIT: I am interested in making a burglar alarm, but have been unable to obtain a suitable circuit using infra-red. I would appreciate any information on a suitable circuit. **(E.M.V., Mt. Keira, N.S.W.)**

● We published an article describing light beam relays in September, 1962; a further article in February, 1963, described the principles of infra-red light beam relay systems. Copies of either article may be obtained for 20c through the Information Service.

ANSWERS TO CORRESPONDENTS—continued

LOUDSPEAKER IMPEDANCE. Can you tell me if there is any simple way of determining the impedance of unmarked loudspeakers? I have discovered that an ohm-meter does not measure this with sufficent accuracy, and assume that it depends on the back EMF generated by the moving coil in the magnetic field. Is it likely to damage the 10-Plus-10 stereo amplifier of November, 1968, if it is operated without a speaker connected. If so, can this be overcome by switching in an 8 or 15 ohm resistor. Also, is it possible to use 4-ohm speakers if two are connected in series for each channel **(G.B.McK., Lane Cove, N.S.W.)**

● There is no simple way of determining voice coil impedances, but the DC resistance of the voice coil measured with an ohm-meter is a reasonable guide. Voice-coil impedance, measured at 400Hz, is not very much different from the DC resistance. It is usually sufficient to make an ohm-meter measurement and take the nearest of the standard loudspeaker impedances as being the nominal impedance of the particular speaker. It should be borne in mind that precise measurement is largely of academic interest, since the impedance is not constant over the full range of audio frequencies. Some of the matters you raise are covered in an article in our December, 1968 issue (Audio Topics page 95) which we assume you will have seen by now. It is standard practice to use a dummy resistive load if an amplifier is to be tested without loudspeakers connected. Two speakers can be operated in series, but it is preferable that they be of the same type.

TEST TAPES? Congratulations on your fine magazine which is presented in such a way that non-technical people like myself can still derive enjoyment from it, as well as a little education. I would like to know if you intend to present stereo tape reviews in your columns. Also, is it possible to obtain a test tape to check the frequency response of a recorder? **(H.H., Nth. Caulfield, Vic.)**

● Thank you for your appreciative remarks. We do review tapes on odd occasions, when they are submitted to us. This happens quite rarely however. It is really a matter for tape distributors if record manufacturers retain a virtual monopoly on the review space by keeping up a regular supply of discs. The last time we checked, test tapes were only available at a professional level — and a "professional" price. No ordinary commercial test tapes have come to our notice.

"VALVE MAN": I was an avid reader of R. and H. in the 40s until I found my days becoming too crowded. With some leisure time now available, I decided to return to "tinkering" and bought my first copy of "Electronics Australia" last month. I was very impressed, if it was possible to improve on R. and H., you have done it. But I find that time has passed me by and left me as a "valve man." Would your "Basic Radio Course" help me? Have you published an up-to-date circuit for a C.R.O. using a 5BP1 tube? **(L.B., Torquay, Vic.)**

● The very rapid development in technology has discovered a lot of people as "valve men." In fact, the introduction of IC's and the "logic" approach has produced another group of "discrete component men." You would probably find the "Basic Radio Course" helpful for general revision and for the limited material which it contains on solid state technology. It will only be a starting point, however, and your best plan would be to build up a few simple projects using solid-state devices. Regarding the oscilloscope, we would suggest that you would do better to forget the 5BP1. After all these years, it may not have a hard vacuum inside. But, apart from that, its large size and limited sensitivity would condemn you to using large metalwork and difficult circuitry. If you want to build an oscilloscope, go for something smaller, say a 3-inch instrument, in which the circuitry is not prejudiced by having to do things the hard way. We note that you would like to see a whole sequence of handbooks. So would we. The big problem is that of producing them!

SIMPLE ORGAN: I have followed your recent monophonic organ designs with interest and your correspondent's attempts (Nov. 1968 edition) to build up a 2-manual polyphonic organ using three oscillators. Perhaps the best way of producing a simple 2-manual polyphonic organ would be to serve the lower manual with four oscillators each serving three adjacent notes, so that the one octave could produce basic accompaniment chords. The upper manual would be served by one oscillator as per the basic design. I feel that the description of voicing filters for your monophonic organ would be of interest to many people. Also becoming very popular now are electronic "drums." Thank you for a consistently excellent magazine. **(R. S. Condong, N.S.W.).**

● Something along these lines would be practical and the oscillator-dividers could be exactly as in the latest keyless monophonic design, with one for every three notes on the accompaniment manual and one for the solo manual. In practice, more than one octave would probably be required in the accompaniment manual if the player is going to be able to play reasonably normal and full chords in all keys. This could be verified by blanking off keys in an ordinary piano or organ and seeking how few it is possible to get away with. We will keep in mind your request for voicing filters but these would be best done in conjuction with a more elaborate monophonic instrument. While, individually, the filters may look simple enough on paper, there is a big difference in total complexity between a simple "gimmick" instrument and one which has become appropriate for some kind of musical "performance." We also have in mind the possibility of working out a system of electronics percussion but, in fact, anything worthwhile can be quite complicated.

SOLID-STATE TAPE ADAPTER. Recently, I wanted to complete my stereo rig, comprising Playmaster 115, magnetic pre-amp and Super Bookshelf loudspeakers by the addition of a tape recorder. I brought a Brenell deck with Bogen heads and then set about finding a suitable adapter. I was disappointed when my search of "Electronics Australia" resulted only in the hybrid Playmaster 119 adapter of September, 1967. The replay unit was satisfactory, but how about a solid-state recording amplifier and bias recording oscillator to match it? **(R.H., Melbourne, Victoria.).**

● At the time we designed the Playmaster 119, components for a solid state bias oscillator were not available through parts suppliers. When designing our circuits, we go to considerable trouble to make sure that all parts are readily available to constructors. Accordingly, we had to compromise by designing a hybrid unit. We may be taking another look at this matter in the not too distant future, and if the components are available, a fully solid-state tape adapter could well be featured in a forthcoming issue. ■

A TIMER FOR SLIDE PROJECTORS (From page 67)

measuring 4-5/8 x 3-5/8 x 2-1/8, manufactured by Eddystone. The interior assembly is shown in the accompanying photograph, giving a clear indication of the position of the transformer and other components. The potentiometer, push-buttons and warning lamp were mounted on the lid, the lamp being held firmly in place with a rubber grommet. A speaker plug-and-socket combination was used to connect the projector to the relay contacts.

After completion of the timer it was apparent that there would be more applications for a regenerative timer than just a slide-changer. In addition to intermittent operation of lights on Christmas trees and in display windows, a timer could be used in "time-lapse" photography and exposure timing. In such applications a warning lamp facility would probably not be required.

In order to fulfil some of these requirements we are presenting a second circuit which has been pruned from the design used in the slide timer. As it happens, this much-simplified circuit can be used as a slide timer without the full facility of the previous device.

It simply consists of the basic PUT timing circuit together with a monostable circuit incorporating a relay. The monostable circuit provides a time dealy to hold the relay closed for a few seconds, allowing time for associated mechanism to engage. The relay holding time may be increased, if required, simply by increasing the 10K-50uF time constant.

Again a diode is used with the time constant network, and a protection diode is wired across the relay winding. Also, the 20uF timing capacitors is a tantalum electrolytic while the 50uF capacitor may be a regular electrolytic. Again a 12V supply is required; the supply circuit shown is suitable.

On the circuit diagram we have shown two buttons labelled "advance" and "hold". In a similar manner to the previous circuit, the advance button charges the timing capacitor very rapidly causing the PUT to fire and activate the relay. However, the hold button simply shorts out the timing capacitor preventing the PUT discharging into the base of T2 and activating the relay.

The range of this timer is between 7 seconds and 1 minute 8 seconds, but this may be conveniently varied by altering the value of the charging capacitor proportionally. Increasing the capacitor will logically increase the maximum and minimum timing periods. However, to increase the overall range of variation, the 100K potentiometer may be increased in value, as determined by individual experiment.

If an electric clock with a sweep second hand is available it may be conveniently used to time the operation of both circuits. The only proviso is that the clock should start instantaneously without manual assistance. By connecting the clock in series with a set of normally closed relay contacts it can be operated as an electronic stop watch.

While we did not finish off the second timer in a completed form, we did mock it up on the bench. Conceivably it could be constructed in a similar fashion to the first circuit, using Veroboard and a small die-cast metal box. However, the ultimate presentation will be up to the individual constructor, and may be tailored to suit particular requirements. ■

Commercial Broadcasting in N.Z. (from page 19)

next general election will be held. Not only would Labour close down private stations, but claims it would create a second corporation to compete with the first. Two virtual State departments monopolising the airwaves in elephantine competition is certainly a prospect which enthralls few.

One more development remains — FM broadcasting. In Wellington, the country's leading technical teaching institution (the Central Institute of Technology) combined with the N.Z. Electronics Institute to apply for an experimental licence for FM broadcasting. Despite the standing of these organisations, the licence has been refused, and departmental policy appears to be not to attract any public attention to the potentialities of the 90-94MHz band (reserved in New Zealand for this service). The N.Z.B.C. would be well equipped to try FM, as it now has transmitter buildings and aerials in excellent sites about the cities for its television service, where FM transmitters (using the medium wave program) could be sited and aerials accommodated on the existing masts.

The B.B.C. pioneered television and FM broadcasting in the United Kingdom, inspired by its responsibilities to the public to improve its service. In New Zealand, what extensions of technical broadcasting — to shortwave, television, etc — there have been, have been mainly forced on a State-dominated authority by progressive private enterprise.

New Zealand's Broadcasting Authority Act may be the opportunity for private enterprise, less trammelled by restriction than before, to speed up the job of giving the country better broadcasting. This can be expected in the program sense, but without safeguards for technical standards it remains to be seen how responsible the private broadcasters will be in this respect. If a spate of licence applications does result, Australia may be invited to renegotiate existing broadcast channel-sharing agreements to accommodate the new broadcasting look across the Tasman. ■

Electric Propulsion Engine (from page 15)

time of between 200 and 300 days. Clearly, there is a limitation, which depends on the launch vehicle used, on the initial weight of satellite that can be placed in orbit.

A more advanced mission is a Jupiter flyby, the analysis for which has already been worked out in detail in the U.S.A. Using an Atlas-Centaur launch vehicle, analysis shows that a spacecraft of initially 1,070KG, powered by four thrusters working at a total power of about 11KW, could reach the vicinity of Jupiter in 900 days. The propulsion system would consume some 386KG of mercury, and a useful payload of some 30KG could be carried. The ion engines would be switched on after injecting the satellite into a Jupiter transfer-orbit, and would continue operating for a period of 470 days. The spacecraft, as envisaged in the U.S.A., would resemble a Mariner 4, scaled-up by a factor of six and deriving power solely through the use of solar cells. The significant aspect of this design study is that no other launch vehicle available to the U.S.A., smaller than a Saturn V, could be used for such a mission.

The advantages of electric propulsion are: first, any given orbital elements may be varied at will; second, the capability of a given launcher/satellite combination is extended; third, the launch window (the period during which a given payload may be placed in a given orbit with the launch-vehicle available) is extended and for a given mission, the propulsion may be optimised to a much greater degree than would otherwise be possible. ■

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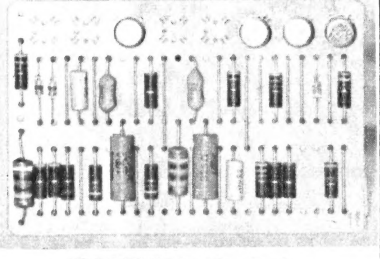

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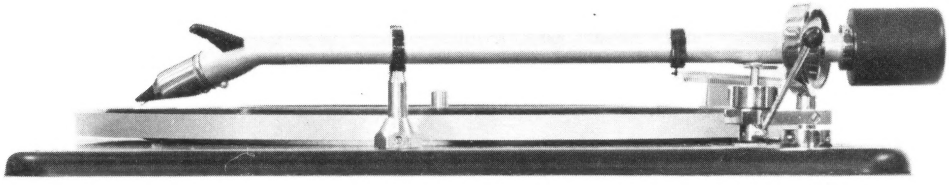
COVER DATE	Issue ON SALE Mondays	BOOKINGS Fridays	COPY I Reset Material Mondays	COPY II Ready for Camera Fridays
FEBRUARY	February 3	December 20	December 23	January 3
MARCH	March 3	January 17	January 20	January 31
APRIL	April 7	February 14	February 17	February 28
MAY	May 5	March 21	March 24	April 4
JUNE	June 2	April 18	April 21	May 2
JULY	July 7	May 23	May 26	June 6
AUGUST	August 4	June 20	June 23	July 4
SEPTEMBER	September 1	July 18	July 21	August 1
OCTOBER	October 6	August 22	August 25	September 5
NOVEMBER	November 3	September 19	September 22	October 3
DECEMBER	December 1	October 17	October 20	October 31

Copy deadline dates are based on the availability of your material to our Sydney Office.
We regret that cancellations or alterations to size cannot be accepted later than three days prior to our booking deadline.

ADVERTISING INDEX

Labcraft HIGH GRADE RECORD PLAYERS Labcraft



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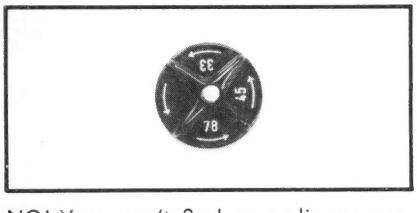

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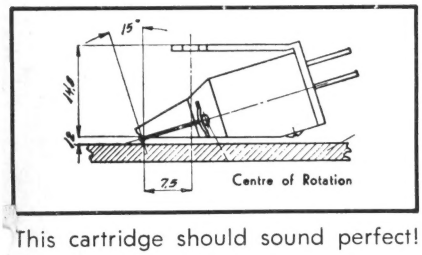
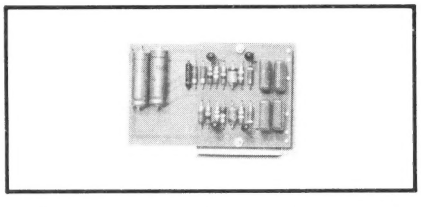
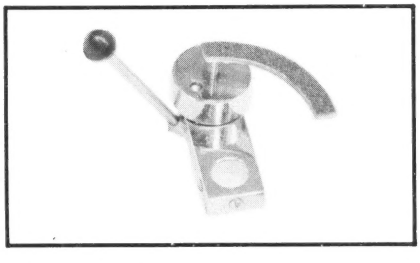


This cartridge should sound perfect!

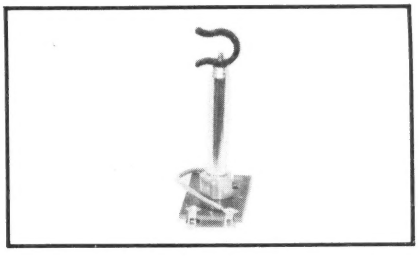
A magnetic cartridge with elliptical diamond stylus set for 15° with a flat response from 20 Hz to 20 kHz, extremely low distortion and perfect square wave, outstandingly good shielding, the ideal tip mass of 1.5 mg. It does in fact sound perfect — it's the B & O SP 9! (SP 8 when fitted to the All Balance arm).



It doesn't matter if your power amplifier hasn't a pre-amplifier input section for magnetic cartridge. The Labcraft player takes the special low distortion, solid state pre-amplifier made by SRT of Copenhagen. Plugs in under the mounting board.



It's child's play (yes literally!) to lower the stylus down gently on the record with the oil damped 'pick up lift'. This is available for All Balance or B & O arms. It is an important contribution to record care besides making the player very easy to use.



Simple — natural — convenient is the unique SRT arm rest switch fitted to all Labcraft turntables or players. Just lift the arm and the motor starts. The switch has a capacitor to eliminate pops.

The base of the Labcraft Player has mitred corners as in the original Danish design. Choice of selected ash or teak or palisander. The smokey clear plastic cover looks magnificent and completes the picture.

Many details of design contribute to the perfection of Labcraft Players. For example:—lubricated in factory for years of playing, fully shielded motor, anti-vibration motor suspension, rim belt drive of special design, arm with in-built anti-skate, interchangeable cartridges, stylus pressure by special spring tension.

Ask your local Hi Fi dealer to obtain a Labcraft Stereo Record Player for you from the sole Australian Agents, **G.R.D. Instruments Pty. Ltd., of 6 Railway Walk, Camberwell, Victoria.** Telephone 82-1256.

B&O Det danske kvalitetsmærke — SRT Scandinavian Radio Television Co. Copenhagen Denmark — G.R.D — SRT Scandinavian Radio Television Co. Copenhagen Denmark — B&O Det danske kvalitetsmærke

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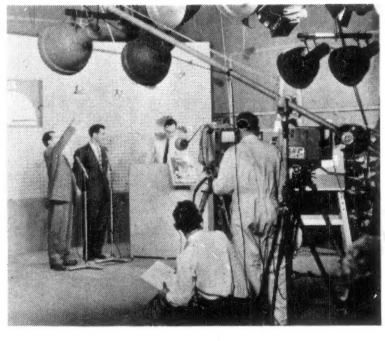

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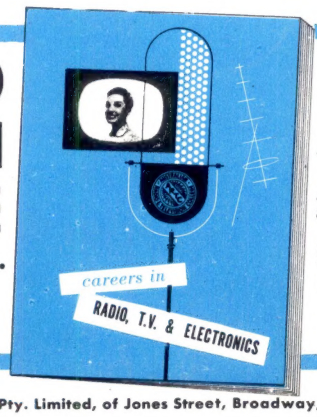

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